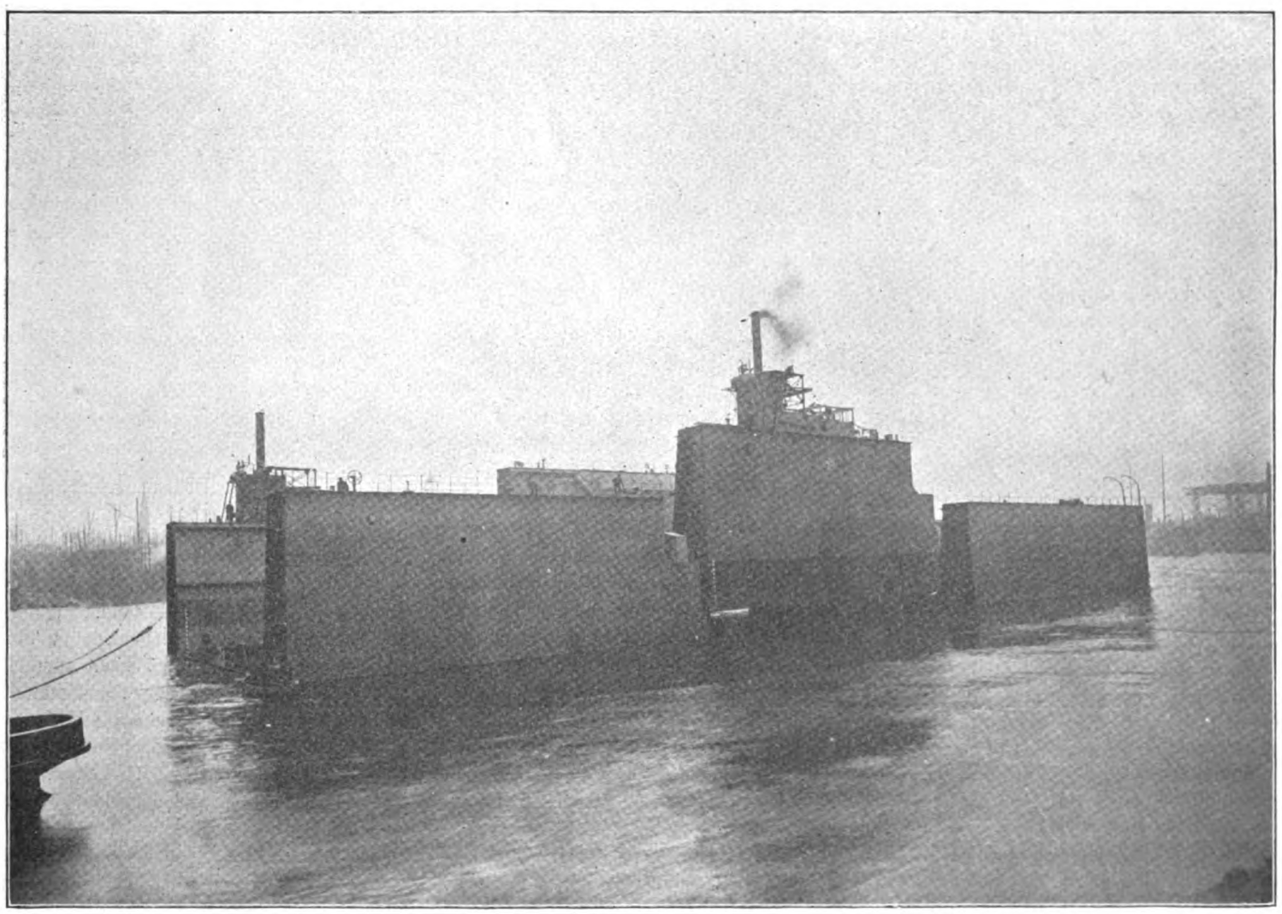
THE MARINE REVIEW

VOL. 38. CLEVELAND, OCTOBER 1, 1908. NEW YORK No. 14

Floating Dock for Callao.

A floating dock, built to the order of the Compania Peruana de Vapores y Dique del Callao, and intended to replace the dock which has done service for some 40 years past at the Callao harbor, has just been completed by Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne. This dock is of the double-sided self-docking type known as the "bolted sectional," and is divided into three separate portions, any two of which can lift the remaining part clear of the water. It is, as a whole, capable of lifting vessels having a displacement up to 7,000 tons in two hours, and the dock has been made of extra width and draught, so that it may be suitable, when enlarged by the addition of a fourth section—making the overall length about 510 ft.—for accommodating vessels of 9,500 tons. As the further section, when added, will have its own pumping plant, the above



FLOATING DRY DOCK FOR CALLAO.

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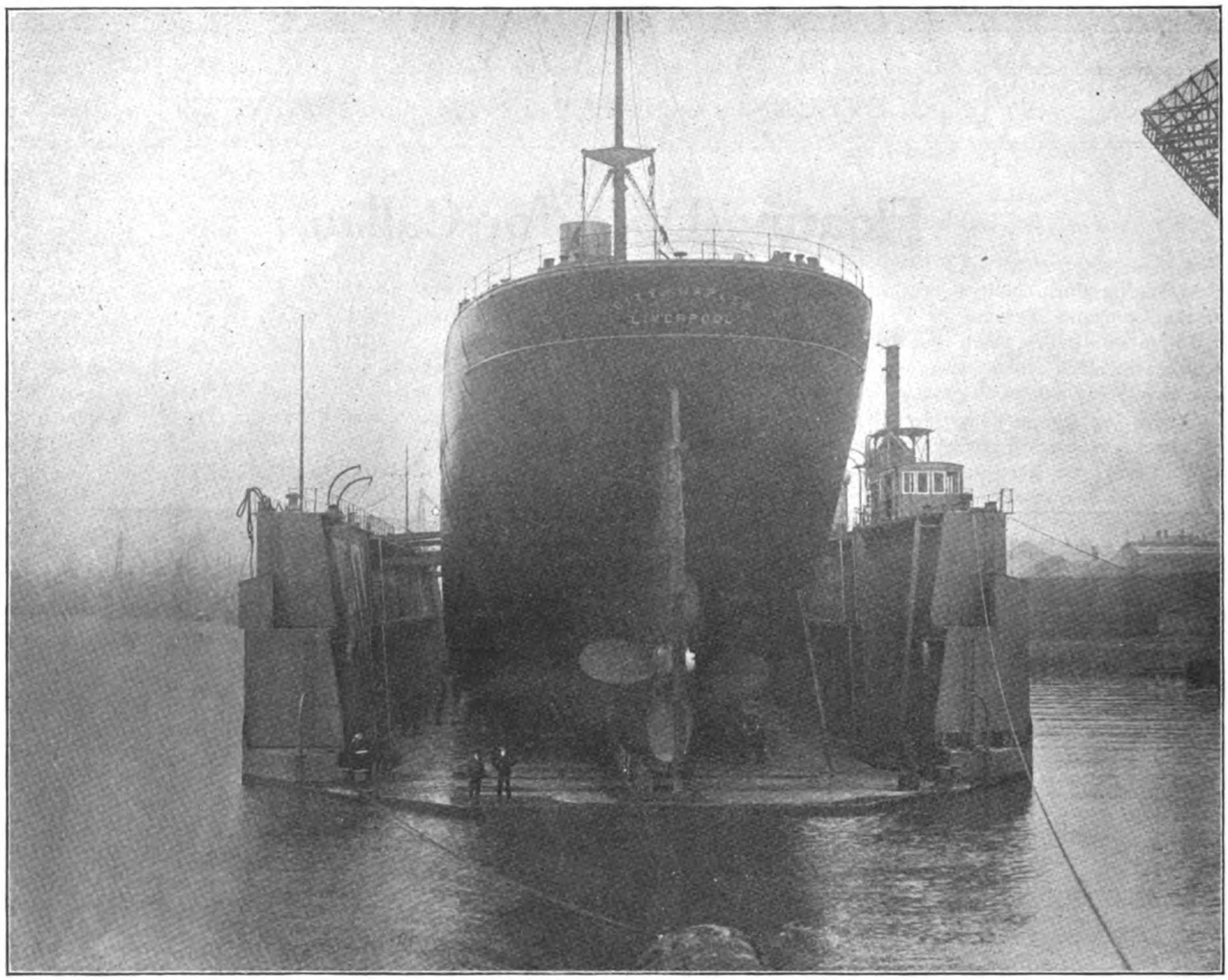
mentioned speed of lift may be retained even for the larger vessels if desired.

The present length of the dock is 385 ft., the overall width 95 ft. 5⅛ in., and the docking width, i. e., the clearance between the rubbing fenders, 70 ft., while the draught over the keel blocks is sufficient to take vessels drawing 22 ft. The length of the center section is 124 ft. 10 in., and the bers, flying gangways, hand capstans, etc., are provided, while there has also been included a heavy mooring outfit of anchors and cables. The Callao dock was launched into the Tyne on June 12, and since this date there has been completed a satisfactory self-docking trial by the lifting of one of the end pontoons alongside the builders' yard, and as a further test the steamship City of Naples, which has of this dock to its distant station on the west coast of South America. The dock left the river Tyne on Thursday afternoon, Aug. 20, in charge of the tugs Zwarte Zee and Roode Zee, of which the latter was specially built for this tow. The Zwarte Zee is 165 ft. by 30 ft. 8 in. by 18 ft., with engines of 1,500 I. H. P., and her bunker capacity is 550 tons. The Roode Zee is 171 ft. by 30 ft. 8 in. by 18 ft., with



FLOATING DRY DOCK FOR CALLAO.

length of each end section is 130 ft. 1 in. As in the other docks built upon Messrs. Clark and Standfield's principle, each section has its own independent pumping machinery and steam supply. The machinery in the Callao dock was constructed by Gwynnes, Ltd., of Hammersmith, and the boilers were supplied by Babcock & Wilcox, Ltd. The pumps are designed to discharge about 130 tons of water per minute. The usual accessories, such as keel and bilge blocks, mechanical side shores, rubbing timrecently been completed by Swan, Hunter & Wigham Richardson, Ltd., for the Ellerman Lines, Ltd., was successfully lifted on July 12. The weight of this vessel is about 4,500 tons, and it was lifted in 1 hour 5 minutes.

At one time the question of dismantling the dock and re-erecting it at Callao was under consideration, but it was eventually abandoned, and Messrs. L. Smit & Co., of Rotterdam, who have had large experience in the towing of floating docks and other craft, were entrusted with the towage engines of 1,500 I. H. P., and her bunker capacity is 650 tons. When completed, this tow will rank as the longest feat of its kind ever carried out by any European tug, the distance of about 11,000 miles which will have to be traversed in accomplishing the journey round the south coast of America being exceeded only by the record towing operation with the "Dewey" dock en route some years ago from the United States to Manila Bay, Philippine islands. Unfortunately the trip has not begun well,

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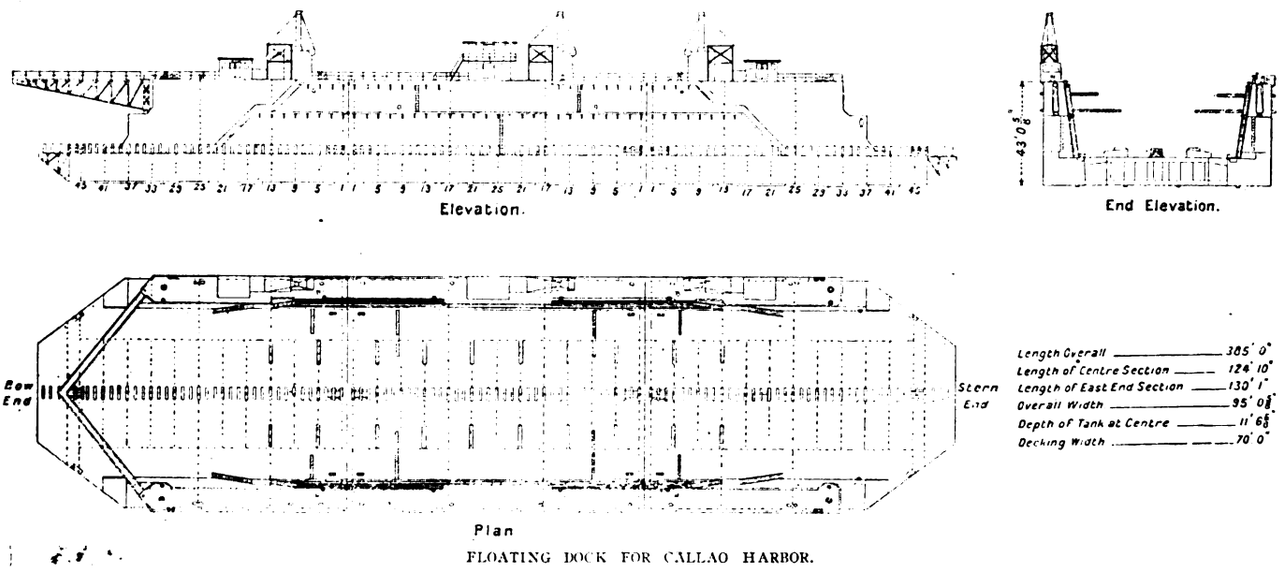
as the dock broke loose in rough weather in the Channel and was only recaptured after some trouble. The journey is expected to last about 100 days. The first call will be at Madeira, the second at Cape Verde islands, and the next at Monte Video. It has been decided to tow the pontoon through the Straits of Magellan, and this will be the first time such a feat has been attempted. During this dangerous passage, a pilot of expert knowledge will be engaged, and there will be much anxiety until it has been safely accomplished. On each tug there is a crew of 16 hands, and on the pontoon itself are 12 men under

and to this all the levers for controlling the various compartments are led. There are four pontoons and two side walls bolted on to the pontoons, which arrangement renders the dock self-docking. Other floating docks which Swan, Hunter & Wigham Richardson, Ltd., have in hand, and which will shortly be delivered, are two double-sided docks, each with a lifting power of about 1,700 tons, for dealing with the river traffic at the port of Para, Brazil, and an offshore dock of 425 tons lifting power, for dealing with the large fleet of trawlers frequenting the port of Fraserburgh.

Philadelphia, for equipping the new battleship North Dakota, being built by the Fore River Ship Building Co., and the Delaware, being built by the Newport News Ship Building & Dry Dock Co. This system is in successful use in the English and German navies, the new English Dreadnought being equipped with same. Catalog 6-0, giving full description of this system, can be obtained from the manufacturers.

COOK'S METALLIC PACKING.

The C. Lee Cook Manufacturing Co., of Louisville, Ky., manufacturers of Cook's metallic rod and Corliss



FLOATING DOCK FOR CALLAO HARBOR.

a captain, for all of whom special accommodation has been built into the sides of the floating dock, which they will not leave until the end of their long journey, a distance of over 10,000 miles.

In addition to the Callao dock, Swan, Hunter & Wigham Richardson, Ltd., have during the past fortnight also despatched from their Wallsend ship yard a floating dock which they have built to the order of the government of Southern Nigeria, which is intended for lifting small river steamers in the Niger. This dock, which is expected to arrive in tow at Lagos about the middle of September, has a length of 140 ft. and a lifting capacity of 400 tons. Its clear beam is 35 ft., and it will accommodate a vessel drawing 6 ft. The pumping plant, capable of lifting a vessel of the maximum lifting power of the dock in one hour, is steam driven, and is housed in erections on the top deck of one of the walls. Upon this deck the valve house is also arranged,

ASSOCIATION OF GENERAL PASSENGER AGENTS.

At the annual meeting of the American Association of General Passenger and Ticket Agents held at Montreal last week, George T. Bell, of Montreal, general passenger agent for the Grand Trunk railway, was elected president; S. G. Hatch, of the Illinois Central, vice president; C. M. Burt, of the Boston & Maine, secretary; O. P. McCarty, of the Baltimore & Ohio, W. F. Herman, of the Cleveland & Buffalo line, and J. C. Halle, of the Central Georgia, were elected to the executive board, succeeding W. H. Taylor, of the Southern railway, C. A. Cairns, of the Chicago & Western, and J. F. Fairlamb, of New York, who retired in keeping with the constitution.

KOERTING PATENT OIL FIRING SYSTEMS.

Two orders for Koerting patent oil firing systems have lately been booked by the Schutte & Koerting Co., of

valve stem packing, has just issued a catalog descriptive of their metallic packing for steam, gas and air engines of every description. This packing is especially adapted to extra heavy duty service on reversing bloom mill engines, blowing engines, rolling mill engines, gas engines, marine engines, locomotives and engines operating under very high steam pressure and superheat. The booklet is illustrated with several engravings, and the concluding pages are devoted to a list of names of companies using this packing.

The St. Vincent, the heaviest battleship yet constructed for the British navy, was launched at Portsmouth Sept. 10. She was laid down in December last.

The monitor Wyoming will be restored to commission on Sept. 28. She was disabled by a broken propeller shaft off the southern California coast three years ago.

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"In the Merchant Service"

The junior engineer passed along the deck on his way "for'ard," and by the expression on his face it would appear that he did not relish the task on hand. Well, when a fellow is making his first trip to sea, especially after having been reared in the ship yard in the belief that the fireman is the engineer's sworn foe and is never more happy than when "doing," violently or otherwise, said engineer, and when a fellow is abruptly told, before he is 24 hours on the ship, to go "for'ard" and turn out a delinquent or find a substitute, his feelings are rather apt to be of a non-enviable sort.

THE DRAMA—AS HE SAW IT.

The oft told tales of the engineers who made a specialty of periodically wiping up the fo'c'sle with one of the crew somehow fade away, leaving in alarming prominence other tales passed along from time to time of more or less bullied members of the crew turning—like the proverbial worm—and recklessly spilling the blue blood of his superior.

On reaching the companionway the junior musters what remains of his courage and manly strength and prepares to descend to the unknown depths of a firemen's fo'c'sle. The appalling odor which increased in intensity as he climbed down the heaving stairway strikes him with full force as he steps into the quarters of the men. Later he learns that the odor is peculiar to fo'c'sles and is generated through the presence of various food compounds prepared by the men and cooked "below" in the ash pits of the furnaces, perspiration-soaked garments, stale tobacco smoke and packed human beings, the whole being further intensified by closed ports and hatches, due to the heavy weather outside.

To the junior's surprise no missile hurling through the thickened air or even muttered curse greets his appearance. The men, engaged in the various pastimes usual to those off duty, look on with mild interest as the junior searches for, finds and proceeds to turn out the delinquent. They even offer respectfully to lend a hand if necessary, as the average fireman has little time for a skulker.

With many rather overdone groans and sighs the missing fireman climbs out of his bunk and with much searching for strayed garments, gets inside his working outfit. The junior, who stands by to see the man safely on the way to the fire rooms, finds in his surroundings much to interest and amuse; that is, to the novice. His attention is drawn to a small group of men seated round a rather short but vivacious fireman of Dutch extraction, said fireman being engaged in giving a reproduction of the latest powerful drama, as he saw it, somewhere in the region of the Bowery. His audience is extremely critical, but good natured, the presence of the engineer spurring the actor and his critics to further efforts in the way of banter.

"Yep," proceeded the little Dutchman, "ven the coitan goes up in t'e fort' act ve are on a shteamer, outvard pound for Chermany. You know that th' fessel is outvard pound as th' cap'n is tressed up svell mit w'ite duck pants and cap and coat speckled mit buttins and gold lace. Dey vas a qua'ter master at th' veel, too, fixed up mit a oilskin suit an' sou'vester."

"Did yez notis anny firemen, Heinz." anxiously inquired one of the audience.

"Sure," said Heinz, turning on his interrogator, "dey come aboard yust pefore th' ship sailed. Yee, but dey vas doity an' did'nt have no kit. Irish, mibbe.

"Aw, cut it out, Clancey," chimed in one of the others, "an' let him come to the shipwreck."

"Dey aind no shibwreck," responded Heinz, anxious to continue his thrilling tale, "she aind no British tramp. Vell, sailin' time comes—an' the passengers, vich vas the willin—mit his gang o' plackhanters an' th' panker's vife—vich dey vos obductin'—god aboard. Yee, it vos funny." The audience roared in sympathy.

"An' all th' sails vos spread—mit th' shib tied to the wharf, too—an' smoke comin' t'ick oud o' th' funnel, an' it aind as high as can keep th' smoke off th' pridge."

"They must have been shakin' 'er up in th' fire room," said one of the audience, anxious to betray his professional knowledge.

"Vell," continues Heinz, "ve sail down th' river und pass Liberty und the Deutchland und sev'ral shteamers. Yee, it vos svell!"

"Did yez pass anny goin' your way?" asked Clancey, his question this time passing unheeded.

"An it got shtormy, mit nopody on th' deck bud th' svell-lookin' panker's vife. All at vunce th' willin' comes creepin' along the deck und graps the panker's vife. 'Vonce und fer all,' sez the willin', 'vill you gimme dose papers?' 'Never,' sez the panker's vife, lookin' up fer help. 'sooner vould I die a t'ousand deaths!' Yee, she did look svell."

"Phwat papers did the villyan want," queried Clancey, "his discharges?"

"Go ahead, an' never mind 'im,"

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said one of the others, noticing that the narrator had paused to think out a crushing rebuke for Clancey, "let's hear how she got out of it."

"Vell," continued Heinz, "yust as the willin' vos goin' to dump the panker's vife off the rail the qua'ter-master, who vos on th' bridge an' had'nt moved the veel since th' fessel sailed, yumped down an' grabbed the panker's vife mit one hant an' punch-ed the willin' into the vater mit th' other. Und who is he all th' time?"

"Sweeney," ventured Clancey.

"Sveeney nothin'," said Heinz, scorn-fully, "he vos the panker's daughter's sveetheart. You see, he vos playin' detectif."

"But how the divil cud a clerk steer a liner down the river?" demanded Clancey.

"Did who say he vos steerin'?" asked Heinz.

"Phwat steered the ship thin?"

"How do I know?" asked Heinz, "you Irish are too tamn particler!"

The junior engineer turns to find his man ready to go aft and take his place at the fires. As they leave the fo'c'sle he takes a last look around. On the whole, he decides, they seem a good-natured, care-free crowd, liv-ing a hard life.

THE "STAND-BY" MAN.

MARINE SIGNALING LAMP.

The accompanying drawings illus-trate an improved type of signaling lamp for marine use, adapted for pro-

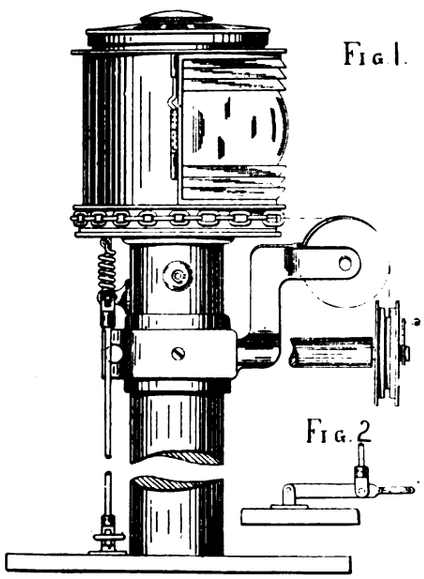

FIG. 1.

FIG. 2

ducing a flash light according to the Morse or other suitable code. The lamp, which is extremely simple in design and operation, is the invention of Henry Endall, of Southampton, England. Fig. 1 in the drawings is a general front elevation, and Fig. 2 a side view of a small detail thereof. Fig. 3 is a side elevation of the lan-tern with the lens attachment omit-ted; Fig. 4, a central vertical sec-tion through the same, including the lens attachment; Fig. 5, a plan of Fig. 3 without the cover, the interior being shown partly above the level of the lamps and partly below the level; and Fig. 6 an elevation of the lens

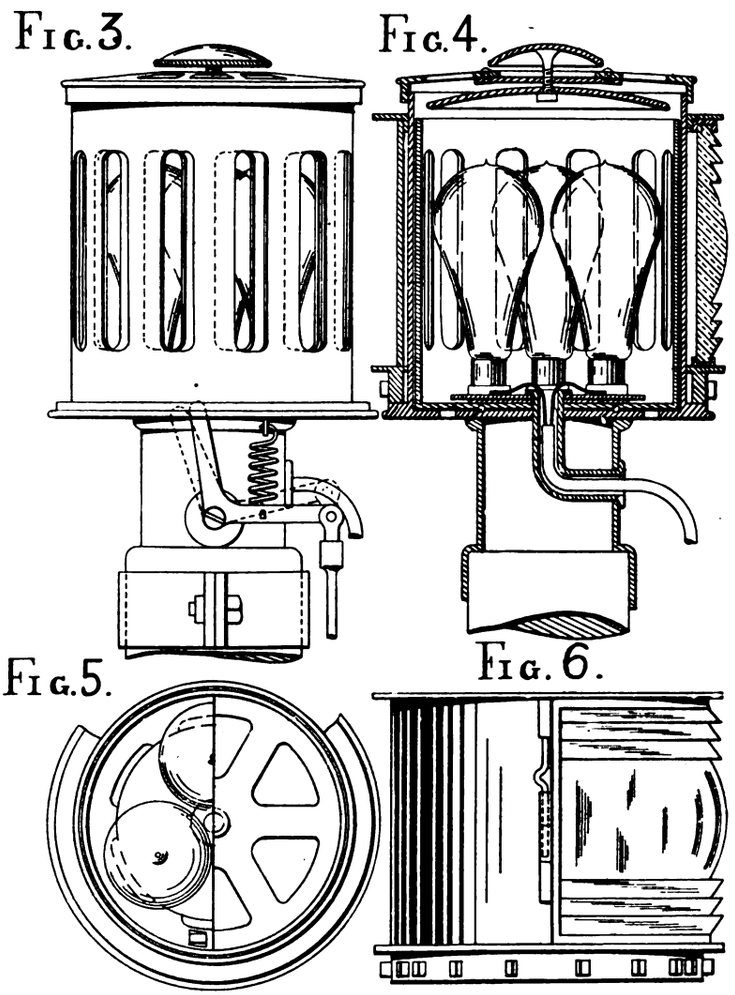

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

attachment which was omitted in Fig. 3.

In the construction of the lamp the lights are inclosed by a pair of cylin-ders, one fitted within the other to form a double-walled cylinder, the in-ner one being so mounted as to be capable of a limited rotary movement and the other being stationary. The cylinders are both provided with slots, spaced preferably at equal dis-tances apart around the circumfer-ence in the fashion of a grid, so that the slots are open or shut according as the cylinders are relatively in one position or the other, but they are normally kept closed. Either cylinder may be rotatable, but in the accom-panying drawings the inner one ro-tates within the outer, the latter be-ing fixed to a convenient base. The inner cylinder is actuated by an elbow or other suitable lever operated from the outside, one arm of which enters a recess in the base of the rotatable cylinder and the other arm of which carries a depressing key, or is adapt-ed to be acted upon directly. In the case of a lamp upon a standard, as in the drawings, this key may be a lever hinged near to the base of the stand-ard, connected to the lever by a rod of suitable length.

The lamps, preferably electric, are carried upon a disc or plate situated at the bottom of the inner or movable cylinder, but is not integral therewith, being immovably fixed upon a station-ary hollow stem which is carried down through the mounting or stand-ard and firmly held in place by a screw nut, such stem forming an axle on which the inner cylinder can rotate. A ball bearing, or washer and collar, is under the base of this cylin-

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der to reduce friction. This stem forms a casing for the electric wires which enter the side of the mount through an opening.

Surrounding the stationary cylinder is a revolving lens attachment in the form of a cylindrical sleeve, having an opening in one part of it fitted with a suitable lens hinged thereto on both sides, which not only increases the range over which the light is visible but provides for a screen which protects the operator from the glare of same and concentrates the rays directly on to the object of intercourse. The sleeve mentioned may rest upon a flange around the base of the cylinder and may be rotated by hand to direct the rays toward the desired quarter. Where this part of the apparatus can not be worked directly by hand, it may be driven round by a pinion acting on a toothed ring and actuated by a shaft in any suitable manner. The drawings, with the exception of Figs. 3 and 5, show a simple arrangement in which teeth are inserted into the lower part of the sleeve, forming as it were a toothed ring surrounding the lens attachment, adapted to be actuated by an ordinary chain such as shown in Fig. 1 passing over a pair of guide pulleys and extending vertically to any desired level, where an actuated wheel suitable for turning by hand is mounted in any convenient manner.

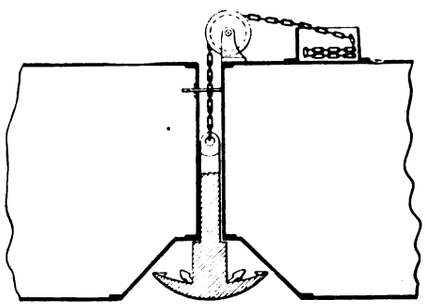
Ventilation holes are provided in the base of the fixed cylinder, and the inner or rotatable one also has spaces to promote circulation and cooling of the lantern. A cover provided with ventilating means is fitted upon the stationary cylinder and its flange may serve to retain the sleeve in position. After each impulse of the inner cylinder by the lever in one direction it is returned to its original position by a spring, shown in Fig. 3. The revolving lens attachment can, if desired, be made so as to provide an opening of variable size. The post or standard on which the whole of the lighting apparatus is mounted may be adapted for adjustment to any desirable height.

Assistant Secretary of the Navy Newberry has approved the plans for the dredging of a channel at Pearl Harbor, Hawaiian Islands, and for the location of a dry dock to be constructed there. Bids will be called for to be opened Dec. 1. The channel is to be dredged to a depth of 35 ft. and a width of 200 yds. The appropriation for this work amounts to $400,000.

ANCHOR FOR SUBMARINE OR SUBMERSIBLE BOATS.

An improvement relating to the anchor of a submarine or submersible boat has recently been patented in the United States by a French engineer. The invention relates to a new arrangement of the anchor, anchor plate or grappling anchor, and consists essentially in providing within the boat a vertical tube of suitable form and dimensions through which the anchor chain passes, and in which the anchor is accommodated in its raised position.

In the accompanying drawing the anchor, the arms or flukes of which are not very long, is suspended vertically in a water-tight tube extending through the hull of the vessel and terminating below in a cavity in the hull of a shape corresponding with that of a casing which would contain



the anchor. The suspending chain extends through the tube and over the chain wheel, the slack being accommodated in a tank on the outer surface of the hull. The weighing or casting of the anchor does not necessitate the opening of the hull, and in no way modifies the stability and conditions of weight of the vessel.

To weigh anchor the wheel is turned from within the vessel, and, when home, the anchor is stopped by the shoulder before its flukes touch the hull, being retained in this position by any suitable device, in this case by a pin passing through the links of the chain. In addition to the advantages named, the anchor thus accommodated offers no resistance to the travel of the vessel. The inventor is Maxime Laubeuf, of Paris.

When the lighter Ariel, loaded with paraffine, took fire in the North river at New York recently, the Cunard liner Slavonia and the mail boat Postmaster General were menaced by the flames. The lighter was got safely to midstream where the fire was extinguished. She was then towed out and sunk on the Jersey flats. The loss is $25,000.

NOTES AND CLIPPINGS.

According to Lloyds Register wrecks reduced the effective mercantile marine of the world in 1907 by 868 vessels, of 851,221 aggregate tonnage, exclusive of vessels of less than 100 tons. Great Britain's percentage of loss was less than that of any other of the principal ship owning countries.

The Compagnie Generale Trans-Atlantique has established a new monthly regular steamship service from Havre to Cuba and New Orleans, with an itinerary varying according to season.

The Argentine parliament has decided to spend $55,000,000 on the construction of warships and the rearming of the field artillery.

European shipping companies are suffering severely because trade and traffic in the Levant and on the far eastern lines are almost at a standstill.

The White Star Line will name its two new great vessels now building for the Atlantic service Olympic and Titanic. The keel blocks were recently laid down at Belfast of the Olympic.

Scotland's fish catch in 1907 was 9,078,059 hundredweight, worth $15,425,525. The industry employed 94,773 men on 10,365 vessels of 141,385 aggregate tonnage, worth $23,640,561.

Asbestos is found in the island of Cyprus, in the Mediterranean. A company organized in 1906 obtained a concession to open early in 1907. It is reported that 1,000 tons of asbestos were mined up to the end of the year.

A Berlin engineering company is fitting out a large steamship with a suction gas plant for propulsion purposes. So confident are the owners in the success of the innovation that they have ordered two more ships to be similarly equipped.

At Dumbarton, Scotland, a ship building firm would like to get a portion of the parish church burying ground in order to extend their premises, and while some people do not mind, others think it would be a sacrilege to agree. The firm, if it doesn't get the bit of ground, will, it is feared, have to leave Levenside for some other place on the Clyde where more accommodation is available.

Some experiments have been recently carried out which appear to show that the sea water round the coast of Ireland possesses a richness in radium not hitherto expected. This result has been extended by measure-

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ments made on samples of water collected between Madeira and England, and also on water from the Arabian sea. In a paper recently read it is shown that the deep-lying sediments of the ocean are exceptionally rich in radium.

The directors of the Cunard company have arranged with Capt. J. B. Watt to continue in command of the Lusitania for another trip or so before entering finally upon his retirement.

A Campbeltown fishing boat recently struck a shoal of herrings, and at one haul bagged $1,150 worth of fish.

A man who had taken a passage on board a Cunarder to the United States broke the journey at Queenstown last week, owing to the inducements held out by the police who desired to interview him.

"I wasn't beggin'," said a marine fireman charged at Liverpool Central police court last week with that offense, "I wuz on'y askin' the loan of a penny."

The committee of Lloyds have decided to bestow the silver medal of the society upon Chief Officer F. D. McArthur and Second Officer A. T. Cooke, and the bronze medal upon each of the Lascars who accompanied them in a boat from the steamship Oolobaria, which effected the rescue of the crew of the sailing ship Fathal Raham, of Ouscat, which was abandoned on June 21 in the Indian ocean. The rescue took place during cyclonic squalls and blinding rain, with a high cross sea running, and it was only with great difficulty and at considerable risk that the rescue was effected without loss of life.

Commemorating 50 years of trans-Atlantic communication by cable, it seems only fitting that the presidency of the Edison service should have this year been taken by one who has been so prominently connected with the system—Thomas A. Edison.

An old sea captain was visiting a certain exhibition, and was greatly interested in the mechanical action of steam whistles. "How far can that one be heard?" he asked, pointing to a huge "buzzer." The young man in attendance was only a deputy, but replied, "Sixteen miles." "Sixteen miles?" said the old salt incredulously. "Well," said the youth, "eight miles this way and eight that way."

The water in the Cuyahoga river at Cleveland is very low, and the steamer Bransford, loaded with ore, could not be towed up to the Central furnaces.

ATLANTIC COAST NOTES.

Office of the MARINE REVIEW,
Room 1005, No. 90 West St.,
New York City.

The new Mallory line steamship Brazos arrived at New York this week from Newport News, Va., to go into commission on the direct service of the line between New York and Galveston, Tex. The principal dimensions of the Brazos are: Length, 415 ft.; beam, 54 ft.; depth, 37 ft., with a displacement of 9,800 tons. The propelling machinery consists of two sets of quadruple expansion engines, having cylinders 23 in., 33½ in., 48½ in., and 70 in. in diameter, developing 8,000 H. P., the steam being supplied by eight Scotch boilers. She has been built to maintain an average speed of 16 knots, is luxuriously fitted throughout and equipped with wireless telegraphy apparatus.

The Commonwealth, of the Fall River line, while on her regular passage from Newport to New York on Saturday, collided with the Norwegian steamer Volund off Race Rock, at the eastern end of Long Island, the mishap being due to the dense fog prevailing. The Volund, bound in ballast from Newburgh to Windsor, N. S., was sunk, all of the crew being saved.

The Metropolitan Steamship Co. has placed the steamer H. F. Dimock in commission, in service between New York and Boston, this addition to the fleet now operating being due to increasing freight business. The company is at present giving a service of 10 sailings per week for freight.

The Norwegian steamship Senator, from Port Antonio, arrived at New York last week, reporting the drowning of Captain Aaskvorld during a storm near the Bahamas. Captain Aaskvrold attempted to save a sail which had been put up in an emergency, and which the wind threatened to carry away, but was swept bodily over the rail by a tremendous sea. The vessel's cargo was almost totally destroyed by the flooding of the holds.

The German bark Brema, which was recently picked up in a disabled condition by the British steamship Lord Iveagh and towed into Hampton Roads, has been libeled in the federal court at Norfolk, Va., by the master of the Lord Iveagh for a claim of $240,000, 60 per cent of the value of the vessel and her cargo. The Brema is valued at $20,000 and her cargo, which was lumber and tobacco, at $360,000.

The Norwegian bark Fox has been towed into New York, after being abandoned by her crew in mid-ocean apparently, by the British tank steamer Luciline. When picked up the bark was adrift and had been hastily abandoned after being in collision. The rigging was a mass of wreckage, the hull, however, being in good condition.

The U. S. cruiser Yankee, which went ashore on the Spindle, north of Hen and Chickens lightship last Wednesday morning, is being stripped preparatory to the attempt to refloat the vessel. The work is being carried out by the navy department, which is constructing a cofferdam for the injured vessel.

The steamer Erik, which accompanied the Roosevelt to the far north, is reported on her way to St. John's, N. F., with her hull damaged by collision with an iceberg. Temporary repairs were made at Turnavik Harbor, on the Labrador coast, the damage being above the water line.

A customs case of considerable importance to the maritime interests of the country was decided last week when the board of United States general appraisers handed down a decision adverse to Moral & Co., of San Juan, Porto Rico, relative to the dutiability of ships' equipment. The test case was brought because of the action of the government in assessing duty on certain parts of machinery used in repairing the steamship Buenos Ayres, a Spanish vessel lying in the harbor of Mayaguez, Porto Rico. The parts necessary to make the repairs on the Buenos Ayres, which had become disabled at sea, were brought into the harbor by the Pathfinder, a vessel owned and operated by a line other than the company owning the Buenos Ayres. In denying the importer's contention that free entry should have been granted the machinery because it was not actually imported, General Appraiser Hay, who writes the decision for the board, says that machinery brought to the United States from a foreign country to repair a vessel lying disabled in one of the American ports must be regarded for the purposes of duty as "imported merchandise."

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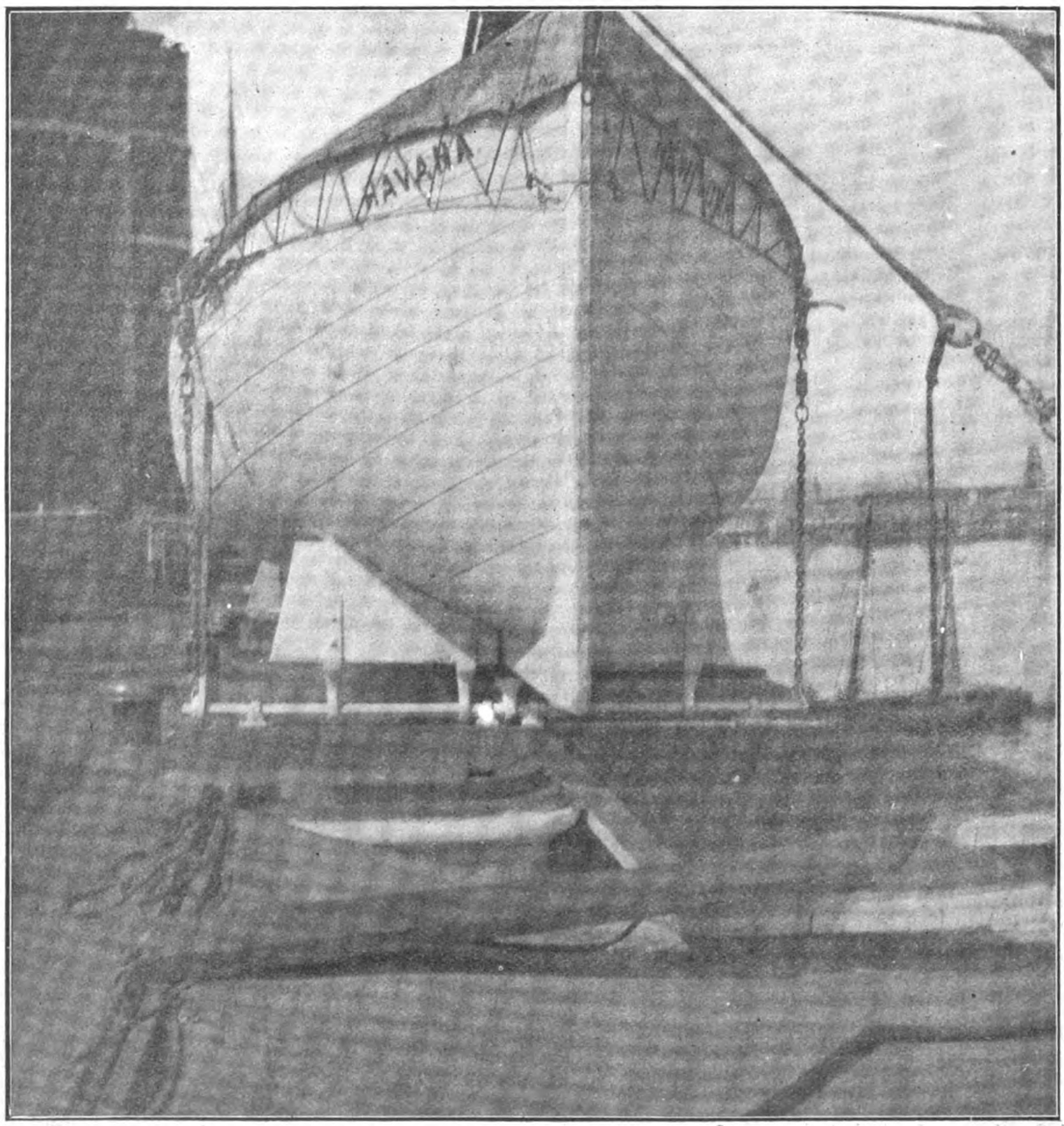
THE RYAN-TANNING DEVICE FOR LAUNCHING LIFE BOATS.

It is only within recent years that any commendable change has been made in life boat handling equipment aboard ship. Though for a decade little atention was given to the improvement of this most necessary apparatus, in spite of the fact that vessels were rapidly increasing in size, speed and passenger accommodation, several devices, each having its individual merits, are now on the market. Among others may be mentioned the Ryan-Tanning boat handling device, an apparatus which recently underwent a series of interesting tests on the steamer Havana of the Ward Line, at the company's pier on the East river, New York.

This apparatus, which is comparatively inexpensive and can be easily installed on any vessel fitted with the ordinary davit and chocks, consists of two rock shafts fastened one under each set of chocks upon which the boat rests, these rock shafts having rollers mounted at the end of short arms upon which the keel rests when locked in position, the roller arms being inclined towards each other at an angle of 32 degrees from the perpendicular. On the keel are fastened two small lugs or stops against which the rollers fit snugly when the boat is in place. At each end of the shafts are cams or hooks to which the lower ends of the chain gripes are fastened, the gripes being slacked or set up at will by means of turnbuckles with which each is fitted.

To release the boat, operating levers, which are fastened on the inboard end of each shaft in a vertical position of sufficient length to insure the proper leverage, are pulled down, this movement operating the roller arms, raising the boat about 1 in., simultaneously lowering the chocks and releasing the chain gripes. This action is partly automatic, as once the roller has passed the perpendicular the weight of the boat will cause the lever to drop to the deck, entirely disengaging the boat and leaving it hanging in the falls, ready to swing out.



RYAN-TANNING BOAT HANDLING GEAR.

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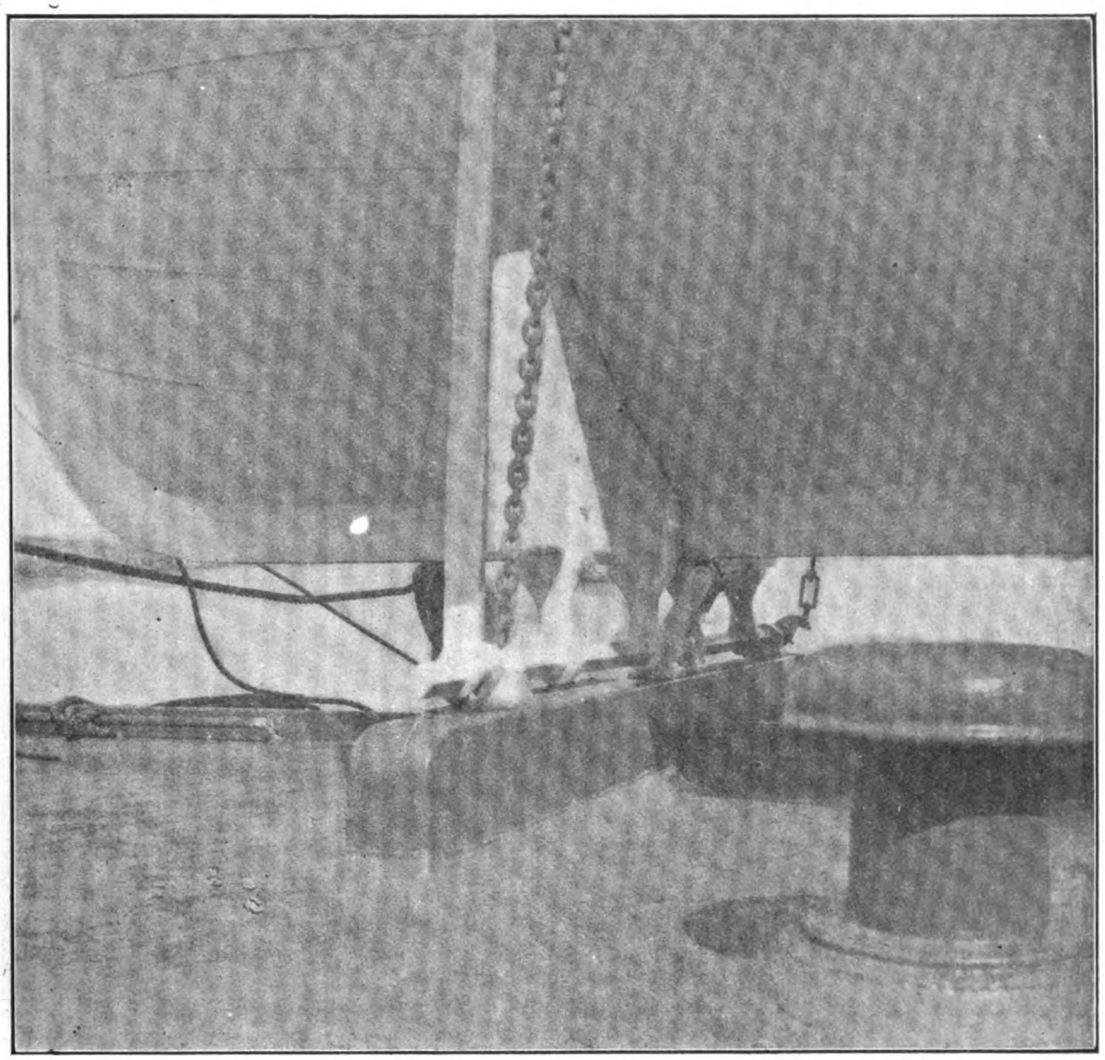
In returning the boat to its position when it is swung inboard over the chocks the levers are brought to the vertical position and the boat lowered into place. The turnbuckles are then slacked to allow the lower link of the chain-grip to be hooked to the shaft and then set up, leaving the boat secure and ready for service.

In the tests carried out on the Ward liner Havana the three starboard boats were swung out with the aid of three men, all ready for lowering, in 36 seconds. One boat was unlatched, swung out and lowered to the water (a distance of 50 ft.) the tackles unhooked and guys and boat painter secured in 37 seconds, the operation being performed by four men. The life boats used in the demonstration were 27 ft. in length and weighed two tons.

The Ryan-Tanning boat handling apparatus is the invention of Capt. Lewis Tanning, of the Ward liner Manzanillo, and Wm. J. Ryan, formerly second officer of the Havana. It is being placed on the market by the Boat Handling Gear Co., 95 Wall street, New York City, of which Capt. F. C. W. Smith is president.



RYAN-TANNING BOAT HANDLING GEAR, SIDE VIEW.

TURBINE FANS FOR NEW BATTLESHIPS.

Turbine fans for the forced draft equipment of the United States battleships Delaware and North Dakota are now under construction at the works of the Sirocco Engineering Co., Troy, N. Y. These fans, 14 in number for each ship, are 27 in. in diameter and will be driven by motors constructed at the works of the General Electric Co., Schenectady, N. Y. The installation is noteworthy for the reason that while the Sirocco turbine fans are in use in nearly all the big trans-Atlantic liners, and in the navies of all the principal European nations, the United States navy is now for the first time adopting them on a large scale. The Sirocco Engineering Co. is also turning out open fans for the United States torpedo boat destroyers Nos. 17, 18 and 19, on which the plenum system of draft will be used.

The secretary of war issued to the customs officials of the New York district last week a description of the flag which will be flown as a warning to shipping that a submarine is at work below the surface of the water. The flag will be flown by the tender or "parent" vessel and shows a black fish on a white field, surrounded by a red border. It has never before been flown in New York harbor.

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PACIFIC COAST NOTES.

Office of the MARINE REVIEW,
302 Pioneer Building,
Seattle, Wash., Sept. 25.

The Heffernan Dry Dock Co., Seattle, has been awarded the contract for repairing the German steamship Anubis, the contract price being $68,870. This figure includes dockage and the expense of towing the Anubis north from San Francisco. The contract calls for the completion of the work in 56 days. This is one of the biggest repair jobs ever let on this coast. The specifications call for fairing and replacing 109 plates; 100 frames and 40 brackets will have to be renewed; bulkheads will be repaired, ceiling tank tops and bilges will be renewed or repaired; all bunker ceilings and hatches must be renewed and the decks will be calked. In addition to this work on the hull, the machinery and boilers are to be generally overhauled; the fire boxes are to be rebuilt; the boilers are to be fitted with magnesia covering and the electrical equipment is to be thoroughly repaired. The Anubis is 382 ft. long, 48 ft. beam, 26 ft. deep, with a registered tonnage of 4,763 gross. Following is a schedule of the bids: Heffernan Dry Dock Co., Seattle, $68,870, 56 days; Moore & Scott Iron Works, $68,750, 56 days; Union Iron Works, $68,900, 60 days; Risdon Iron Works, $73,750, 64 days; United Engineering Co., $79,000, 60 days; British Columbia Marine Railway Co., $80,000, 65 days.

The steam schooner Shna-Yak has arrived at Eagle Harbor where she will be repaired by Hall Brothers Marine Railway & Ship Building Co. The repairs will cost about $4,000. The Shna-Yak struck a rock at Point Arena, during a thick fog on her last voyage from Puget Sound to San Pedro and narrowly escaped being totally wrecked.

The stern wheel steamer Craigflower is being overhauled at Victoria, B. C. Her frames are being strengthened and new engines are being installed. As soon as the work is completed she will operate on the Sheena river from Port Essington, carrying freight for the railway construction camps of the Grand Trunk Pacific railway. R. J. Macdonell will operate her.

The Washington state railroad commission has decided that piers A, B, C and D, owned by the Columbia & Puget Sound railway at Seattle should be taxed as commercial property and not as railroad property as has been done heretofore. This decision affects a number of other piers owned by railroad interests in Seattle and Tacoma.

The United States cruiser Colorado, which has been undergoing repairs at the navy yard, Puget Sound, has left the dry dock. Upon leaving the dock it was found that the Colorado had a list of several degrees to port. It was later found that the list was due merely to the improper loading of ammunition and stores and not to leaky plates as was first reported. The cruiser will leave the yard on time.

The latest move in the merciless rate war being waged between the Canadian Pacific railway and the Puget Sound Navigation Co. for the passenger traffic between Seattle and Victoria and Vancouver, B. C., has been the reduction of the round trip rate between Seattle and Vancouver to $1.25 by the Puget Sound Navigation Co. The distance between the two cities is about 135 miles and the new rate is the lowest in the history of Puget Sound steamboating. The fare to Victoria, 60 miles, is 25 cents each way. It is expected that the war will be continued throughout the winter as neither side is showing any signs of relenting.

Capt. John Bermingham, supervising inspector United States steamboat inspection service, will return to his home office at San Francisco this week. Upon Capt. Bermingham's departure the Seattle office will be in charge of Inspectors A. N. Walton and Thos. J. Henry, from St. Michael, Alaska, which office is closed during the winter. The regular local inspectors, Whitney and Turner, will return from their vacations Oct. 1 and take charge of the office again at that time.

Latest advices from Alaska indicate that the wreck of the American bark Star of Bengal bound from Wrangle to San Francisco with a cargo of canned salmon is one of the worst disasters that has occurred on the Pacific coast in years. The Star of Bengal struck on Helm Point, Coronation Island, in a heavy sea last Sunday morning (Sept. 20) and went to pieces 45 minutes after she grounded. At 4 A. M. Sunday the bark anchored in seven fathoms with comparatively no wind. The wind, however, rose rapidly; at 8:45 the anchors ceased to hold; efforts to beat off from the shore were unavailing and at 9:45 A. M. the bark struck. By this time the wind was blowing a gale. Two tugs, Hattie Gage and Kayak, stood near the fated craft, but offered no assistance. Capt. Wagner of the Star of Bengal openly accuses the captains of the tugs of criminal cowardice and asserts that for four hours before the storm reached its height every man aboard could have been taken off in safety. As it was, 95 Chinese and 15 white men lost their lives.

OBITUARY.

Capt. Wm. Gegoux, who died recently, was one of the most competent among the younger generation of masters on the lakes, and his death was most untimely. He was born in Clayton, N. Y., in 1872, and was of French-Canadian descent. He removed to Cleveland when 16 years of age and shortly thereafter became

CAPT. WILLIAM GEGOUX.

cabin boy on a schooner sailed by Capt. Robinson. He was promoted continuously through the various positions of watchman, wheelsman, mate. When the Pittsburg Steamship Co. was formed he became one of its captains and was master of the steamer Zenith City when he died. He was married in 1900 to Miss Edith L. Nelty, who, with one son, survives him.

Four seamen were suffocated and a fifth partly overcome by the fumes of burning pitch and oakum in the forepeak of the British bark Puritan as she lay at anchor in President Roads, Boston, last week. The vessel was but slightly damaged by the fire.

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PIG IRON SITUATION.

While the advance made during the preceding three months has been maintained, but little more has been accomplished in September. While some sales of pig iron have been made in the east, aggregating about 75,000 tons, yet buying is not general. The market in the central west has been extremely quiet, and in the south prices are firm, and in competition with the northern product are higher for many delivery points.

The coming of cold weather has had a tendency to hasten building operations and specifications against steel bar contracts have been coming in freely. Railroads have been buying both cars and car fittings in fair quantity, but rail contracts are small. There is some inquiry for furnace coke for next year, but sellers are not disposed to make contracts so far in advance.

DETERMINING A STEAMER'S SPEED.

The occasion often arises when we wish to determine the probable speed of a steamer, given the revolutions, pitch and slip of the propeller. The following rule gives a quick mental method of solving this problem which will be found to be accurate within 3 per cent in all cases and within 1 per cent in most ordinary cases:

Rule.—Given the pitch of propeller in feet per revolution, the revolutions per minute and the slip expressed as a decimal. To find the speed of the steamer, multiply the pitch by the revolutions. Subtract 0.10 from the given slip and multiply the difference by the product of the pitch and revolutions, then subtract this product from the product of the pitch and revolutions and the difference will be the speed in miles per hour.

For example. Given 225 R. P. M., 8-ft. pitch and 20 per cent slip. $225 \times 8 = 1{,}800$. $0.20 - 0.10 = 0.10$ and $1{,}800 \times 0.10 = 180$. Now $1{,}800 - 180 = 16.20$ miles per hour.

Proof: $225 \times 8 = 1{,}800$ ft. per minute with no slip. $1{,}800 \times 60 \div 5{,}280 = 20.40$ miles per hour with no slip. $20.40 \times 0.80 = 16.32$ miles per hour with 20 per cent slip. This shows the error of the short method to be 0.9 per cent in this case.

The above rule may be more compactly expressed algebraically as follows: Let N = R. P. M., S = slip expressed as a decimal, P = pitch.

Then, speed $= (N \times P) - (S - 0.10)(N \times P)$.

AROUND THE GREAT LAKES.

The steamer F. G. Hartwell, which stranded in St. Mary's river, will be docked at Ecorse.

The dredge Gladiator, owned by M. Sullivan, of Buffalo, burned at the mouth of the Detroit river this week. She lies in 15 ft. of water.

The steamer Wawatam of the Pittsburg Steamship Co.'s fleet, bound from Milwaukee with coal, went ashore on Poe's Reef. The wrecking steamer Favorite was sent to her relief.

The steamer J. H. Wade, bound for Calumet with coal, stranded 16 miles north of Calumet. The steamer Alfred Mitchell pulled on her, but could not release her. She will have to be lightered.

The William Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa., have acquired all of the Zoelly turbine rights for this country and are prepared to construct the Cramp-Zoelly turbine for marine propulsion.

The steamer Tempest No. 2 and barge C. G. King, owned by the Grace Harbor Lumber Co. of Detroit, have been sold for $15,000 to Seymour Wells and Capt. E. J. Eber, of Tonawanda.

The Grand Trunk railway has bought the car ferry Manistique. The Manistique was built in Cleveland in 1903 and has been running between Manistique and Ludington. The Grand Trunk will put the car ferry on the Milwaukee-Grand Haven route.

The barge Atmosphere was crushed by the steamer Republic while lying at the Solvay Process Co.'s dock in River Rouge this week. The Atmosphere is owned by the Marine Contracting Co. of Port Huron. She will be repaired at Port Huron.

The steel steamer Frontenac of the Cleveland-Cliffs fleet went on Parisian Island last Sunday. The wrecker Favorite has been sent to her relief. The Frontenac is loaded with ore and her forward compartments are full of water. As she lies in an exposed position it is feared that she may be badly damaged.

The barge Montezuma in tow of the steamer Amazonas struck one of the steel dredges belonging to the Dunbar & Sullivan fleet in the channel at the Limekiln crossing this week. Three spud anchors on the dredge are broken and she is leaking.

The steamer Sonora, aground near Harbor Beach, was released in record time by Capt. Alex. Cunning, master of the wrecking steamer Favorite. It was necessary to jettison about 1,000 tons of her ore cargo. Two of the Sonora's forward tanks were punctured and an air compressor was put aboard to keep the water out. The Sonora was taken to Cleveland and put in dry dock.

At the close of navigation for the season of 1908, the light exhibited at Eagle River light station, located on the western bank at the mouth of Eagle river, northern shore of Keweenaw peninsula, Lake Superior, will be permanently discontinued.

The steamer Calumet of the Lackawanna Steamship Co.'s fleet, bound down with ore, went aground at the head of Stag Island, St. Clair river, this week. She is out about 2 ft. The tug A. C. Harding and lighter Rescue are working on her.

The steamer Lyman C. Smith of the L. C. Smith Transit Co.'s fleet hit the west pier at the entrance to the Canadian canal at the Sault this week and sank in 24 ft. of water with a hole 3 ft. wide and 20 ft. long in her side. Her cargo of ore will be lightered after which she will be patched up and pumped out.

The steamer Arthur H. Hawgood, which stranded on Cathead Point, Lake Michigan, was released by the wrecker Favorite after jettisoning 600 tons of her coal cargo. The Favorite released her in less than 12 hours, though car ferries and government steamers had pulled on her without baing able to move her.

The wooden steamer Neshoto of the Gilchrist Transportation Co.'s fleet, which went ashore at Crisp Point, Lake Superior, Sunday afternoon, is a total loss. Her crew was taken off by the life savers from Crisp Point station. The stranded freighter was pounded to pieces in a northwest gale. The Neshoto was built in 1889 for Robert R. Rhoades and was one of the best wooden freighters on the lakes. She was 284 ft. keel and 42 ft. beam. She was not insured.

It is interesting to note that cargoes of coal have been transferred from Cleveland to Buffalo by water. The steamer H. G. Dalton carried her second cargo from Cleveland to Buffalo last week. The coal was shipped to Cleveland from the West Virginia district and the Dalton received 20 cents per ton for delivering it to the Lackawanna Steel Co., at Buffalo. This combination rate is said to work out 75 cents a ton cheaper than the all-rail route.

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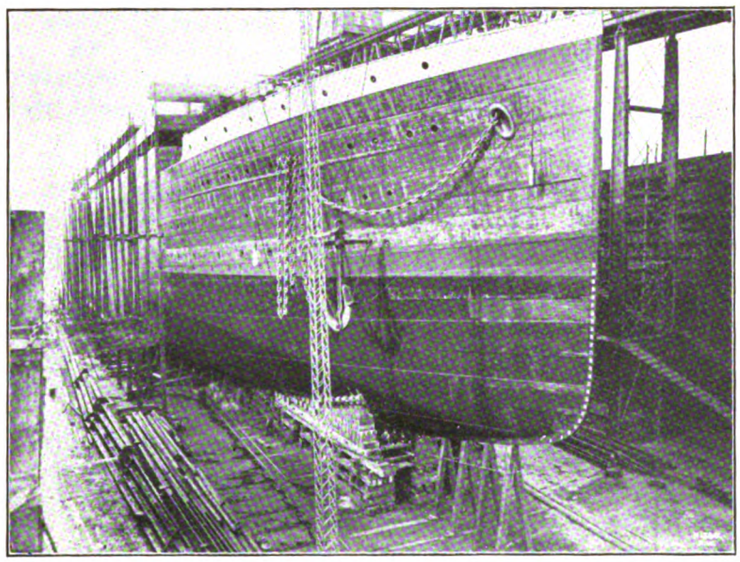
LAUNCH OF THE WHITE STAR-DOMINION LINER LAURENTIC.

On Thursday, Sept. 10, the fine large triple screw steamer Laurentic was launched by Messrs. Harland & Wolff, Ltd., Belfast. The launch of this vessel is an event of more than ordinary interest in the shipping world. As previously announced, the Laurentic will signalize the entry of the White Star line into the Canadian trade, and thus the strengthening of one of the most important ties in our imperial connection.



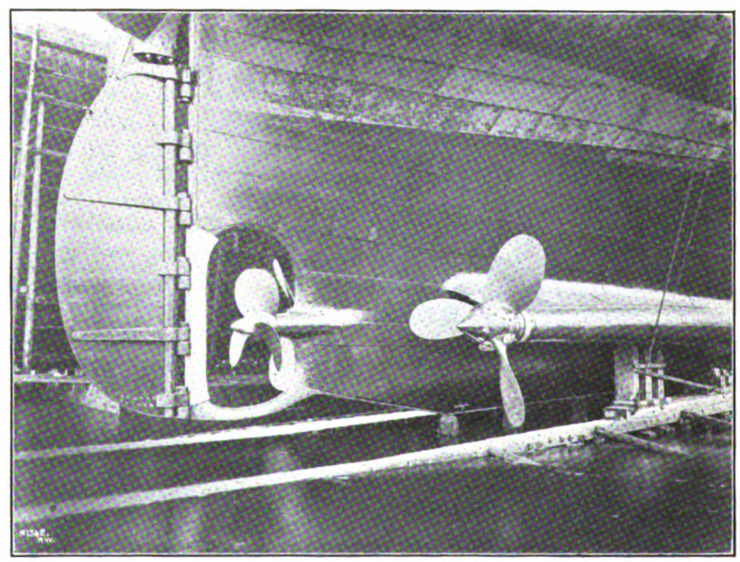
WHITE STAR CANADIAN LINER LAURENTIC JUST BEFORE LAUNCHING.

The new departure has been heartily acclaimeed by all interested in the development of the trade and commerce between the United Kingdom and Canada, as it is recognized that a company which has attained the highest reputation in the New York and other important trades will bring to the new connection thsoe qualities of enterprise, foresight and commercial activity that have made the line so successful in the other great ocean routes. It is confidently anticipated therefore that this connection will be the means of stimulating the trade between the mother country and that great dominion of the west which has recently been the scene of such memorable historic gatherings, celebrating so auspiciously the happy results —social, commercial and imperial— from the blending under the British flag of two great races differing in temperament but equal in courage, endurance and the other qualities essential to national ability and progress.

The launch of the Laurentic is also specially interesting on account of the adoption in this vessel of a combination of reciprocating engines with a low pressure turbine, the Laurentic being the first passenger steamer designed with this arrangement of machinery. Moreover, it has been generally assumed that the adoption of this novelty in the Laurentic is some indication of the owners' intentions with regard to the machinery of the other large liners which they are contemplating. This arrangement of machinery constitutes the vessel a triple screw steamer, each of the wing propellers being driven by four crank triple balanced engines, and the central propeller by a turbine. The object is of course to retain the advantages of the highly perfected balanced reciprocating engines and at the same time get the benefit of the further expanison of steam in a low pressure turbine, whilst avoiding the necessity for an astern turbine, which is essential in steamers fitted with turbines only, whereas in this vessel both for going astern and maneuvering in and out of port the reciprocating engines will be more than sufficient, as they will develop over three-fourths of the total combined horsepower. It is very appropriate that this practical revolution in steamship machinery, due to the genius of British engineers, should be introduced into the Laurentic, and thus signalize in a special manner the introduction of the White Star line into the Canadian trade— one of the most important services of the empire.

The Laurentic will be the largest vessel in the Canadian trade, being 565 ft. long by 67 ft. 4 in. beam, and 14,500 tons gross. She is designed to carry a large quantity of cargo, also a full complement of passengers— about 230 first class, 430 second class and over 1,000 third class.

Needless to say the Laurentic will be, like all the other vessels of the White Star Line, designed and built on the most approved principles, nothing that long experience and practical knowledge can suggest being wanting to make her as perfect as possible in construction, arrangement and appointments. She has been built on the cellular double bottom princi-



WHITE STAR CANADIAN LINER LAURENTIC SHOWING PROPELLERS.

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ple, the double bottom extending the whole length of the ship, and specially strengthened under the engines to give still greater rigidity in the vicinity of the machinery. The vessel has nine watertight bulkheads, dividing her into 10 watertight compartments. As of course is well known, the double bottom in addition to being an element of strength and security provides space for water ballast, which is also carried in the fore and after peaks.

The arrangements for cargo are of the most approved kind. There are six cargo holds, and the bunkers are specially arranged to facilitate the coaling.

Those who witnessed the launch were much struck with the handsome lines of the vessel, and when complete the Laurentic will have a very fine appearance.

The derricks and other appliances for working the ship and cargo are of the latest pattern, special attention being paid in the design of this vessel to the requirements of shippers in the Canadian trade, and the vessel will have large refrigerated chambers both for provisions and cargo.

The passenger accommodation in the new vessel has been carefully arranged on the most generous principles, and it is confidently expected that the Laurentic will prove a great favorite. Added to the good sea-going qualities of the vessel the accommodation will be of the most comfortable and pleasing character. A feature of the entrances and public rooms will be their height and general roominess, and the staterooms will have the same characteristic. The decorations will also be of a truly artistic character, realizing the ideal of the artist—richness and simplicity combined.

The first class staterooms will be situated in a deckhouse on the lower promenade deck, and also forward on the shelter deck. There will be a number of cabins en suite, with private lavatory and bathroom adjoining each suite.

The first class saloon on the middle deck will be a very handsome room, paneled and framed, finished flat white, relieved with elaborate carving. The dado and furniture will be in oak, and the floor parquetry. The saloon extends the whole width of the vessel and will have seating accommodation for 160. It will have the popular "well" arrangement overhead, with veranda for the bandstand.

The first class lounge on the upper promenade deck will be in Louis XV style, artistically paneled in oak; parquetry floor.

The reading room on the same deck will be in white in the style after Adam Bros. This room will also have a parquetry floor.

The first class smokeroom on the upper promenade will be decorated with embossed leather and handsomely carved framework round the windows. The furniture will be of mahogany, and the floor india rubber tiles.

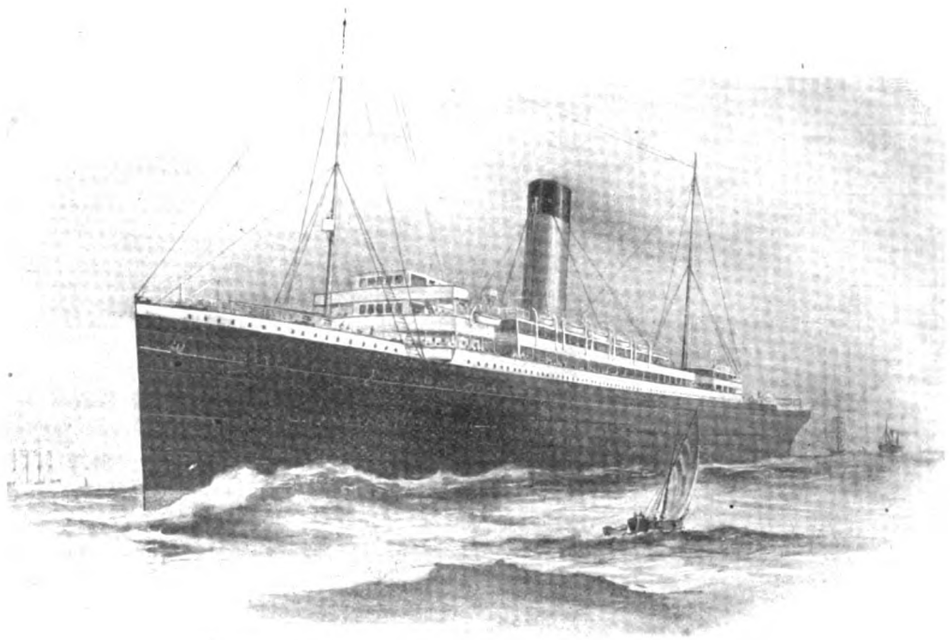
There is an electric passenger elevator serving four decks.

The second class staterooms are on the shelter deck; the saloon on the middle deck—a very fine apartment extending the whole width of the ship and to seat 262. The second class library is on the lower promenade deck, and the smokeroom on the upper promenade deck—both elegant apartments, tastefully decorated in polished hardwood. The second class passengers on this vessel will find the provision made for their comfort second to none on the Atlantic.

The third class dining room, which is aft on the upper deck, is also an exceptionally good room, extending the whole width of the ship.

The promenading spaces on this vessel will form a special attraction, the fullest advantage being taken of the vessel's size to provide the pleasurable recreation so much enjoyed by Atlantic voyagers.

The vessel will be fitted up with the latest and most improved Marconi system of wireless telegraphy, and will also have a submarine signaling apparatus.



WHITE STAR CANADIAN LINER LAURENTIC AS SHE WILL APPEAR WHEN COMPLETED.

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THE MARINE REVIEW

DEVOTED TO EVERYTHING AND EVERY INTEREST CONNECTED OR ASSOCIATED WITH MARINE MATTERS ON THE FACE OF THE EARTH.

Published every Thursday by

The Penton Publishing Co.
CLEVELAND.

BOSTON.....73-74 Journal Bldg.
BUFFALO.....932 Ellicott Sq.
CHICAGO.....1328 Monadnock Blk.
CINCINNATI.....First National Bank Bldg.
NEW YORK.....1005 West Street Bldg.
PITTSBURG.....510 Park Bldg.
SEATTLE.....302 Pioneer Bldg.

Correspondence on Marine Engineering, Ship Building and Shipping Subjects Solicited.

Subscription, U. S. and Mexico, $3.00 per annum. Canada, $4.00. Foreign, $4.50. Subscribers can have addresses changed at will.

Change of advertising copy must reach this office on Thursday preceding date of publication.

The Cleveland News Co. will supply the trade with the MARINE REVIEW through the regular channels of the American News Co.

European Agents, The International News Company, Breams Building, Chancery Lane, London, E. C., England.

Entered at the Post Office at Cleveland, Ohio, as Second Class Matter.

October 1, 1908.

INTERSTATE COMMERCE COMMISSION'S RULING ON SHIPPING.

A recent ruling of the Interstate Commerce Commission has created widespread consternation among shipping interests both on the coast and lakes and a concerted effort will be made by them to convince the commission that the ruling is beyond the intent of the act creating the commission and is moreover not warranted by any condition now affecting the shipping trade. In point of fact, while remedying nothing, if permitted to stand there is potential mischief in the ruling. The ruling in question is No. 66, made on May 4 last, and promulgated in the Bulletin No. 2 conference rulings issued July 9 last. It reads as follows:

"66.—Joint rates between a water and a rail carrier subjects the former to the provisions of the act. —A steamboat line agreed upon joint rates with a rail line for certain passenger and freight traffic. Held, that it could not unite with a railroad company in making a through route and joint rate on a particular traffic without subjecting all its interstate traffic to the provisions of the law and to the jurisdiction of the commission."

A reconsideration of this ruling has been asked by vessel interests and accordingly the commission will meet on Oct. 16 for the purpose of giving interested parties an opportunity to give their views concerning the correctness of the ruling. Should this ruling stand it would result in immeasurable injury to existing steamship lines while working no corresponding benefit to the public. Water transportation is the common leveler of rates. No one has ever complained of excessive transportation charges by water. The highways being free, the moment the rates become excessive that moment competition arises. There is no analogy between rail transportation and water transportation. It is possible to create a monopoly by rail through land grants and franchises, but it is impossible to monopolize waterways. It was never the intent of congress to subject the waterways to the same jurisdiction that obtains over the railroads. Let us consider for a moment the application of this ruling upon existing lines, the establishment of which has probably meant a lifetime of work and the expenditure of millions of dollars.

The ruling says that a steamship line cannot unite with a railway company in through billing and through ticketing on a particular traffic without subjecting all of its interstate traffic to the jurisdiction of the commission. In other words, the Detroit & Cleveland line cannot sell a passenger, for his own convenience, a through ticket to Grand Rapids, Mich., without subjecting its entire business between Cleveland and Detroit to the jurisdiction of the commission with the necessity of publishing tariffs that cannot be revoked or altered without due notice. On the other hand anyone could charter a steamer and engage in interstate traffic between Cleveland and Detroit, undercutting and underselling the established line, without the commission having the slightest jurisdiction over it, and without the D. & C. line having any redress whatever, since it could not alter its rates to meet the new competition without extended notice. Moreover, the wild or tramp vessel is in no way affected by this ruling. It seeks its cargo wherever it can find it and accepts whatever rate it can get on the theory that any rate is better than no rate at all.

This is the kind of competition that established lines would have to meet unless they abandoned their through business altogether. Why should they be subjected to this annoyance? The practice of through billing is designed for the convenience of the merchant and manufacturer and for the facility of commerce. It is a convenient arrangement and spares the shipper the annoyance of looking after the transfer of his goods at a distant point. Why, because of this practice, should the commission seek to extend its jurisdiction over the port to port commerce of the steamship companies as well? To do so is to harass and embarrass a business which is beset with many inherent vicissitudes and legislative handicaps already. There is no business on earth that is hedged about by legislative restrictions as shipping by water. The ship is subject to a system of law that has no counterpart on land. Her owners, officers and crew have liabilities unknown in land carriage. She is even subject to confiscation for various infractions and by the maritime world is treated as a sentient being, answerable for her acts as though she were human. In her construction she is subject to government approval and must bear annual inspection by government officials. She must be officered by men licensed by the government and must carry the number of crew directed. She must be employed only as licensed and cannot either enter or leave port without

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government sanction. Every move she makes is known.

The fixed policy of the law is to make her safe, but it is also to facilitate her employment. To seek now to limit the field of her operation is a blow at a privilege that was ancient when Rome was young and which has stood unchanging through all the ages. The right of the ship to pursue her calling has been safeguarded by nations since time immemorial, but now she is asked under this ruling to surrender her through business, both passenger and freight, or forego her independence as a water carrier. Both of these services are interwoven in the fabric of her business and both are necessary to her profitable existence. Neither the one nor the other could singly support the costly machinery of an established line. The building of these lines has not been the work of a day or of a year, but of long periods of time. The trade has demanded steamers of splendid proportions, costly to build and costly to operate, and it has them. These steamers represent an enormous outlay of capital and could not be profitably operated on through business alone or port to port business alone, and yet if this ruling stands one or the other must be abandoned. It spells ruin to existing lines. It puts the established line at the mercy of any pirate of commerce.

The government has spent millions to develop its waterways for the sole purpose of cheapening and facilitating transportation. Why should an arm of the government now seek by an arbitrary ruling to render the economical administration of the waterways impossible? Waterways are nature's highway and are intended to be free. Being free, the question of rates can safely be left to competition. It never was the intention of the framers of the act that railroad legislation should include waterways. This latest ruling interprets the act in a manner not intended by congress and is a positive menace to capital invested in steamship lines.

THE MARINE ENGINEER AS WE KNOW HIM.

A marine engineer who recently called at our office expressed, during the course of conversation, some surprise that brothers of "the cloth" seemed to have the preference where a vacancy was to be filled in a position on land, especially when the position was one calling for a man of marked ability as a practical engineer, possessed of an iron nerve and keen judgment. The engineer had recently called upon a former shipmate filling an enviable position in one of our larger cities, and while there met the superintendent and his other assistant, all of whom were marine engineers. Our friend was enthusiastic about the positions held by the superintendent and his assistants, forgetting for a time, until we gently directed his attention to the oversight, that *he* holds a position undreamt of a few years ago, when he was one of three engineers on a steamer engaged in the South American frozen meat trade.

Whether it is that the marine engineer always has in mind the possibility of suddenly being called upon to display hitherto unthought of ingenuity in repairing a disabled set of propelling machinery, or realizes just how much is dependent on his ability to "hold down" the most complicated, compact and varied assortment of machinery in existence, the fact remains that he stands in a class by himself, a man of rapid decisions tempered with good judgment, untiring energy and marvellous patience. It is only necessary to look into the records of the past year or two, to see what the marine engineer has accomplished in the way of meeting the demand for rapid travel, particularly in the trans-Atlantic passenger service, where the largest and fastest passenger vessels in the world are propelled by turbine engines. The past year or two also records some noteworthy marine repairs, made under most adverse circumstances, as in the case of the Eagle Point.

It is not only the grasp of detail and capacity for work that recommend the marine engineer. His ability to adapt himself to circumstances is one of his most valuable attributes. We remember on one occasion asking an engineer of a typical tramp steamer why he was so laboriously constructing a hand-feeder oil can from some scraps of sheet metal, especially when an elegant can could be purchased by the tramp ship's owners for a small sum. He paused long enough in his efforts with the soldering iron to gaze pityingly upon us and announce that there were two good reasons why he didn't ask for the hand-feeder. One reason was that his ship was no millionaire's yacht, the other being that he was desirous of preserving his job. On another occasion we met two tramps engineers on the wharf of a port some few thousand miles from New York. They were bound for their vessel, one of the engineers carrying a short bar of steel picked up somewhere on the dock. As it was a more than usually dark night, the steel bar, to the stranger, might have had a rather sinister appearance. It developed, however, that the bar would "come in handy" at some future time when the engineers of a certain tramp steamer would find it necessary to fashion some new machinists' tools. The tramp engineer is a happy-go-lucky individual, with a wonderful instinct for adaptation.

Apropos of the versatility of the marine engineer we have in mind an assistant who, on the installation of a small refrigerating plant aboard his vessel, promptly proceeded to acquire, by contact with the men installing the plant, endless questioning and buying up all available works on the subject, a good working knowledge of the system. He it was who, when trouble came to the system, haunted the little refrigerating room and nursed the striving machinery with untiring care. The ship was not overmanned by any means and his fellow engineers were more pleased than otherwise to let him take voluntary watches around the leaking ammonia system. The passing years saw this engineer sign on with various types of steamers and gain a reputation as an expert on refrigeration. His fellow engineers referred to him, not unkindly, as an "ice machinery crank," and gladly fell back on him when an unusual hitch occurred. We recently heard that he had been offered, and accepted, the position of superintendent in a large refrigerating plant in New Zealand, and know that he will make good. And his is only one instance of many we could mention.

Taking everything into consideration it is little wonder that the marine engineer, as our caller remarked, seems to have the preference when a position is to be filled calling for a man whose experience has so eminently fitted him to fill it.

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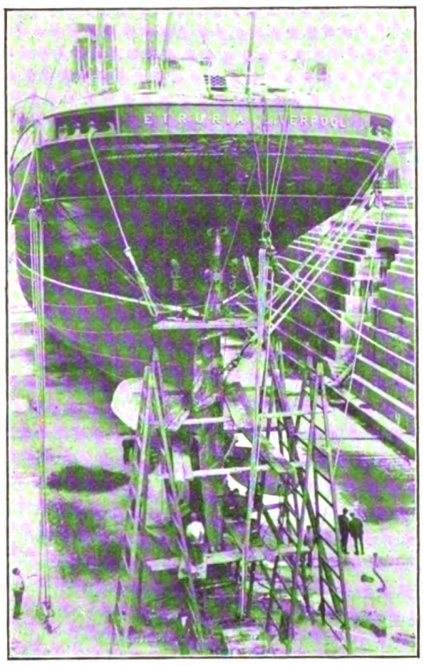
THE CUNARD ETRURIA IN COLLISION.

The Cunard liner Etruria, which should have sailed from Liverpool on Wednesday, Aug. 26, with over 650 American first and second cabin passengers, had to be put back into dock because of having been in collision with one of the Mersey dock board hoppers. The accident was of a very serious nature and somewhat remarkable. It appears that the Etruria was being brought up the river stern first to take up her anchorage opposite the landing stage before coming

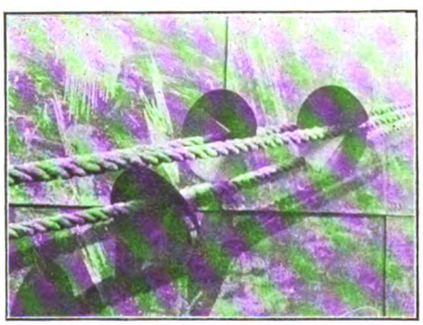


ETRURIA IN DRY DOCK AFTER COLLISION.

alongside in the afternoon to take her passengers on board. By some means or other she came into collision with the hopper which was crossing her stern, and both vessels became fast, the screw of the Etruria having pierced the port bow of the hopper. Besides, the impact was so great that the steersman of the latter was knocked overboard and drowned. The screw of the Etruria being firmly held by the hopper, and her rudder being unworkable both vessels were out of control, and immediate help of tugs had to be requisitioned. For hours efforts were made to separate the vessels but hawsers snapped time after time as if they had been but a piece of string. This remarkable tug of war lasted for about five hours until at last they were pulled asunder, and it was then seen what an enormous rent had been made in the hopper's port side. She rapidly filled and sank before efforts could be made to beach her. It was known that the Etruria had sustained some injury but the extent could not be ascertained accurately until she was drydocked, and further seeing that in any event an examination would be necessary before she could proceed on her voyage, the Cunard management decided to lay up the Etruria, and dispatch the Umbria in her place. It speaks well for the organization of the Cunard company that they were able to do this by Friday, entailing only two days delay, during which the Umbria was victualled, coaled and generally got ready for conveying the 650 stranded passengers of the Etruria. While this work was being done the comfort of the passengers was thoughtfully attended to by the Cunard staff, and the best of accommodation found for them in the leading hotels in Liverpool. The passengers were embarked on the Umbria on Friday afternoon, Aug. 28, and the vessel sailed on the evening's tide. The damage to the Etruria is mainly to the rudder, which has been bent and torn. She is being repaired in dry dock, and will be ready to take the Umbria's sailing from Liverpool on Sept. 9.

RAT GUARDS.

The Pacific coast was badly scared last spring by the discovery of several cases of bubonic plague in San Francisco, and since then the health authorities have been exerting every effort to stamp out and prevent any spreading of the malady. It is thought that the infection is carried about by



RAT GUARDS ON THE MOORING LINE.

the harbor rats that stowaway on the ships plying from port to port. A crusade, therefore, has been inaugurated against these rats and the lines of all steamers tying up to wharves are provided with rat guards.

The accompanying photograph shows the rat guards on the lines of the steamship Tremont as she lay at the dock at Seattle. It is thought that if the rats can be prevented from climbing out the mooring ropes they will not be able to get aboard the ships and travel from port to port. As the photograph shows, the rat guard is simply a smooth, concave sheet iron cone, which is made in halves and lashed to the mooring rope. Its diameter is about 26 inches. The concave side faces the dock and effectually prevents a rat from climbing out the rope.

All ships tying up to wharves at Pacific coast ports are required to provide their mooring lines with these rat guards.

FALLS HOLLOW STAYBOLTS.

The Falls Hollow Staybolt Co., Cuyahoga Falls, O., recently made a large shipment of Falls Hollow Staybolt iron to the Great Southern of Spain railroad; also to the Australian government railways, Brisbane, Australia, the Payta-Piura railway, Payta, Peru, and the Western railway of Havana, Havana, Cuba. The company also has on hand at present a large order for Falls Hollow iron for shipment to the Ferro Carril de Entre Rios railway of Argentine, and for the North Brabant German Railway Co. of Gennep, Holland. The 10 locomotives recently ordered by the International & Great Northern railroad from the American Locomotive Co., are to be equipped throughout with Falls Hollow bolts, as well as the six locomotives ordered from the Baldwin Locomotive Works by the Iowa Central railway, and one locomotive ordered by the Mexican Central railway.

A new machine shop and foundry is under construction for the Goldschmidt Thermit Co., of 90 West street, New York City. The building is to occupy a site 34 x 90 ft. in size, just back of their present factory in Jersey City, and it is to be fitted up for the purpose of handling to better advantage the extensive repair work which is now being carried on at these works. Traveling cranes will be provided, and no expense will be spared to make the building the most complete Thermit repair shop in the country. Special attention will be paid to the rapid execution of repair to electric motor cases, truck frames, cast steel gear wheels, crank shafts, and, in fact, any wrought iron and steel sections not exceeding 2,000 lbs. in weight.

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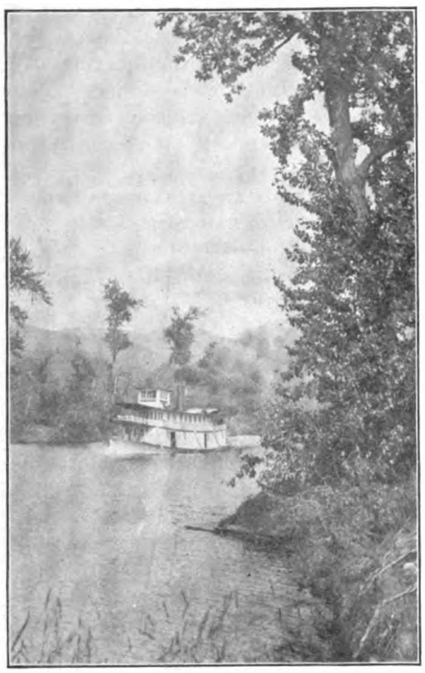
A ROCKY MOUNTAIN STEAMBOAT LINE.

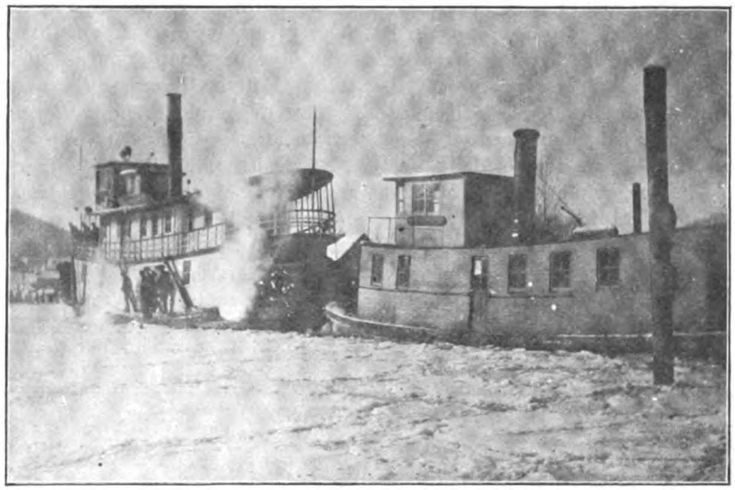
There is a line of steamers operating on Lake Coeur d'Alene and the St. Joseph river in the heart of the mountainous state of Idaho, which on account of its unique surroundings and the character of territory served is unusual and remarkable in marine affairs.

Lake Coeur d'Alene is situated in the northwestern "panhandle" portion of Idaho, 30 miles east of Spokane, Wash., from which city it is reached by electric and steam railways. The lake is 27 miles in length, with its long axis lying north and south. At its southern extremity enters the St. Joseph river (familiarly termed the



STEAMER SPOKANE, RED COLLAR LINE.

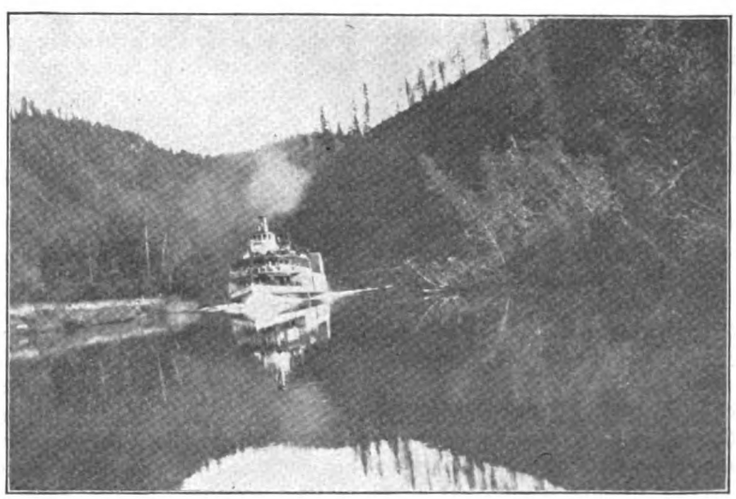
shadowy St. Joe) which winds in a general easterly direction into the heart of the Coeur d'Alene mountains. This river is one of the most remarkable streams on the American continent. Its altitude is a little over 2,100 ft. above sea level, and it is claimed that it is the highest navigable river in the world. The valley is about two miles wide at its lower end, tapering to scarce a quarter of a mile at the head of navigation, 40 miles from the lake. Across the floor of this valley winds the river, which is at no point less than 150 ft. wide and 20 ft. deep. Mountains rising from 1,000 to 2,000 ft. above the river bed flank the valley on both sides. The stream is virtually a natural canal leading into the mountains and at most seasons of the year has no perceptible current. Lake Coeur d'Alene is from 50 to 400 ft. deep, and the lake and river together form a natural highway slightly over 60 miles in length.



BREAKING ICE ON THE ST. JOE RIVER IN WINTER.

In 1879 the United States army built the first steamer operated on this waterway. She was named Amelia Wheaton and was a part of the equipment of old Fort Coeur d'Alene, then maintained at the north end of the lake, where now stands the busy little city of Coeur d'Alene, Idaho. Amelia Wheaton was a stern paddle wheel craft, 100 ft. long by 16 ft. beam, designed and built by Capt. Sorrenson, and was used to chase Indians and to carry wild hay from the upper St. Joe valley, where it grows luxuriantly, to the post at the lower end of the lake. The progenitor of the extensive line of steamers now found in this district was the 50-ft. propeller Echo, which established tri-weekly service from Coeur d'Alene to St. Joe, the head of navigation, in 1886. In 1888 Amelia Wheaton was sold to private parties who operated her on a regular schedule on the lake. One of the men most prominently connected with the development of navigation in this region is William Ferrell, who now resides at Ferrell, Idaho. Mr. Ferrell has been actively interested in the development of the business from its inception to the present day and is now owner of the 80-ft. stern wheel steamer Ferrell.

The valley of the St. Joe river is now settled with prosperous farmers, extensive lumbering and mining operations are carried on in the hills, while on the river are the two thriving villages of St. Maries and St. Joe. At



STEAMER IDAHO ON THE UPPER ST. JOE RIVER.

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the southern end of the lake is the town of Harrison, the gateway to the Coeur d'Alene mining district, which produces half the lead mined in the United States.

To serve this community with transportation the Red Collar steamship line, a local corporation of which J. C. White, Coeur d'Alene, is manager, operates seven modern steamers. In the summer months triple daily service is maintained from Coeur d'Alene to St. Maries and double daily service to St. Joe, while the special fast express steamers Idaho and Flyer are operated between Coeur d'Alene and Harrison.

Daily service is maintained to the head of navigation throughout practically the entire year. In the winter this often requires difficult and extensive ice breaking, as many as three steamers being required at times to force a passage.

STEAMER COLFAX OPERATED AS A MAIL STEAMER BY THE RED COLLAR LINE.

The most important member of the Red Collar line is the side paddle wheel steamer Idaho. She is 144 ft. long and has a speed of 15 miles an hour. Her engines are of the old clack valve type and have had a checkered career since their first installation on a Mississippi river boat years ago.

The lake and river is under the jurisdiction of the state of Idaho which maintains no steamboat inspection service of any nature. It may be said to the credit of the Red Collar line, however, that only experienced pilots and engineers are employed and the steamers are as thoroughly equipped and safe as any operating under the United States steamboat inspection laws.

FIRE FIGHTING EQUIPMENT FOR TUGBOATS.*

R. H. NEWBERN, SUPERINTENDENT INSURANCE DEPARTMENT, PENNSYLVANIA RAILROAD.

The development of the tugboat as a fire-fighting machine was largely due to its superior advantage in fighting waterfront fires, as compared with the difficulty usually experienced by fire departments in working from an inshore position.

Railroad companies and other owners of valuable waterfront properties operating their own towing services recognized the value of such protection over 30 years ago, and in a small way began to equip their tugs with fire apparatus. These tugboats made a creditable record in actual fire service, and, as a matter of fact, demonstrated the usefulness of city fire boats, the first of which was built a few years later.

There has been almost no attempt west of the Atlantic seaboard to equip tugboats with fire apparatus. This is due, perhaps, to a slight extent, to the difference in the character of the property to be protected. In the east the risk lies chiefly in long, narrow piers extending in some instances over 1,200 ft. into the water, while along the great lakes and inland rivers the water front is usually a continuous bulkhead and generally more accessible to the city fire department. The style of tugboat also differs: the western boats operating on inland rivers with short bends have smaller but high power units.

Assuming the average tugboat to cost from $40,000 to $50,000, an expense for fire equipment of about $3,500 might be assumed to be a reasonable and proper expenditure, and the suggested equipment stated below is not intended to exceed such amount.

*Paper read before National Fire Protection Association, at Chicago.

It is hardly fair to charge the entire cost of the fire pump to fire protection. It serves an emergency purpose on vessels equipped with surface condensers in the event of a breakdown of the circulating pump—a connection being usually provided between the fire pump and condensers; it is also used to pump the bilge and has a separate suction connection for this purpose. The fire pump, also by means of pipe connections through the side of deckhouse, can render assistnace in pumping out vessels in a sinking condition. For this purpose all well-equipped tugs carry about 40 ft. of 6-in. rubber suction hose, interwoven with a steel bent spring, having one end fitted with a brass strainer. This feature is at times valuable to marine underwriters and to the owners in rendering salvage services.

DESCRIPTION OF AN AVERAGE BOAT AND EQUIPMENT RECOMMENDED.

Displacement—300 tons.

Dimensions—Length, 100 ft.; beam, 24 ft.; depth, 12 ft.

Tonnage—Gross, 185; net, 125.

Speed—Twelve miles per hour.

Hull—Angle iron frame, with floor beams and keelsons of angle-bars; hull plating, decks and deck house of mild steel; two bulkheads (watertight) of ¼-in. steel plates.

Power—Boiler: Cylindrical "Scotch" type, designed for working pressure of 160 lbs.

Engines: Fore and aft, vertical compound with link valve gear, connected with surface condensers, developing 700 H. P.

Propeller—Four-bladed open-hearth steel single screw, on forged steel shafting, 8½ in. diameter.

Pumps—Circulating: Centrifugal, steam-driven, 6-in. stroke and 6-in. cylinder.

Air (vacuum): Vertical simplex, 8-in. stroke, 6-in. steam cylinder.

Boiler Feed: Vertical duplex, 6-in. stroke, 4-in. water cylinder.

Fire: Duplex, plunger type, 12 x 9¼ x 10 (800 gallons per minute).

Where salt water is pumped, internal fittings should be brass composition—including cylinder lining, piston plunger, piston rod, valve body and seats.

The fire pump is preferably placed below the water level, affording a slight head on the suction side to avoid priming.

The difference in ratio of piston

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areas in the fire pump as compared with national standard specifications, is due to the fact that marine boilers for tug service are designed for a working pressure of about 150 lbs., while fire pumps ordinarily operate under lower steam pressures.

Suction is provided by an 8-in. copper pipe, with two sea connections from opposite sides of the boat, one well under the bottom and the other from 3 to 4 ft. below water level. Between the suction pipe and side of hull a brass fitted valve is flanged on an 8-in. cast iron box riveted to the inside of hull.

A strainer of ½-in. wrought iron plate, with ½-in. holes, is bolted to the outside of hull, the combined area of openings being twice the area of suction pipe. A ½-in. steam connection is run to each box.

Two suction connections are advisable. While the upper is generally used the lower is brought into service when ice or driftwood would choke the upper strainer. Steam connections are fitted to the valve boxes. A steam jet exerting a reverse pressure through the strainer will very often force away obstructions.

Wrought iron strainers are recommended for use on metal hulls to overcome galvanic action resulting from use of brass or copper when in the presence of a salt or saline solution. In fresh water or on wooden hulls brass or copper plate strainers are recommended.

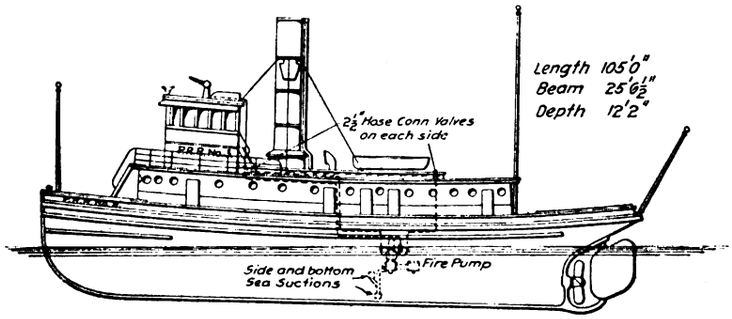
The piping should be galvanized wrought iron. The pump is fitted with five delivery pipes, two 3-in. pipes with outlets on forward end of boat on each side of upper deck and two similarly placed on the after end.

The fifth outlet is a 4-in. copper pipe connection to top of pilot house supplying a permanently located nozzle.

The delivery pipes from pump are connected with a manifold fitted between the delivery side of pump and its air chamber, and each connection has an angle valve, placing the control of all water delivery in the hands of the engineer in charge of the pump.

In the installation of the delivery pipes no angle fittings are used. Wherever turns are necessary the pipes are bent to as large a radius as possible to reduce friction loss. Between the pump and outlets the pipes are led so that the water when quiescent will drain back to the pump.

In the new city fire boats the main discharge pipe from fire pump is carried direct to cast iron turret with a number of hose connections, each controlled by a separate gate valve and surmounted by permanent nozzle. This arrangement is practicable for tugboats, and besides the economy in piping is more convenient for connecting and laying hose, and places the entire control of valves under the supervision of one man.



Pennsylvania Tug With Fire Apparatus.

The rules and requirements of the board of supervising inspectors, United States government, provide that fire pumps on all classes of steamers, including tugboats, shall be fitted with "water gage and a pressure relief valve adjusted to lift at 100 lbs. pressure," it being the purpose of the latter requirement to protect fire hose from excessive pressure. It is generally permissible, however, on boats where good quality hose is carried to raise the limits on relief valves during a fire as high as 150 lbs. This additional pressure is of great advantage where long leads of hose are necessary to reach buildings on shore, distant from the water front, and particularly when three lines are Siamesed through one nozzle.

Equipment.—The character and amount of equipment to be carried will be regulated by the capacity of the fire pump, steam supply and number of crew.

Hose.—Six hundred ft. of 2½-in., best quality, 4-ply rubber, on two stationary reels, 300 ft. each, located in deckhouse closets, or on deckhouse roof and protected by waterproofed canvas covers. The superiority of rubber for this service is generally acknowledged, due to the constant exposure to moisture and the lack of facilities for properly drying hose on a tug.

Couplings.—Should be expansion ring and of the same type, diameter and thread as the local corporation. Where a boat is employed in waters adjacent to two or more cities having different standards, adapters should be provided to permit connections with each. Where necessary a supply of enlargers should be provided for connecting the tug lines to automatic sprinkler systems, and to "Siamese" connections on the outboard end of fire mains, installed on many of the large piers.

Turret Nozzle-Siamese Deluge Set. Nozzle to be of brass, easily manipulated, with 1¼-in. tip, permanently located on top of pilot house. Usually with the average fire pump this nozzle has an effective horizontal throw of about 110 ft. A "Siamese" deluge set should also be provided. This consists of 8 ft. of 4-in. hose, having nozzle with large tip supplied from three 2½-in. hose connections, with an automatic check valve in each. This is an effective device, throwing a large stream a great distance.

Play Pipes (4).—To be brass, smooth bore, 24 to 30 in. long, with tips varying from 1⅛ in. to 1¼ in. openings. Two pipe holders should also be provided, to be placed in holes cut in top of deck rail on each bow. A cellar pipe should also be carried.

Other Equipment.—Two hand chemical extinguishers, 3 gallon capacity, two axes, two pike poles, two burst hose jackets and six fire pails.

Crew.—The full complement will vary between five and seven men, made up as follows:

Captain (Pilot).
Engineer.
Fireman (2).
Lineman (1 or 2).
Cook.

The captain, engineer and one fireman will be occupied with their respective duties, leaving three men to handle hose lines, with the captain in charge of the turret nozzle. For communication between the pilot house and engine room the speaking tube is preferable to bells and gong, which might be confusing, should the tug be maneuvering around a fire on its own bell signal.

Tugboat protection has been developed to such an extent by one com-

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pany owning numerous water terminals that a separate tugboat fire alarm system is installed on its properties with indicator and gong in the float office, where tugs are always on duty, and a tug can be brought into fire service in a few minutes. It is also the practice to assign a tugboat to the larger terminals on Sundays and holidays for fire service only.

In one instance where a large water-front terminal is provided with an effective private high-pressure fire line, in addition to a fleet of tugboats equipped with fire apparatus, the latter is considered fully equal in efficiency to the former.

No recognition has been given to tugboat protection by underwriters. What has been done has been solely for self-protection, and it is possible, if a reasonable allowance in rate were made to owners of tugs or owners of water-front properties operating a towing service, it might serve to encourage the more general introduction of these valuable adjuncts in fire extinguishment.

It may be stated that the equipment described above is intended to make each tugboat about equal in efficiency to a steam fire engine. Nothing less has been considered adequate.

In obtaining data for this paper the conditions in Boston, New York, Philadelphia, Baltimore, Norfolk, Buffalo and Chicago were looked into. Boston, with its extensive and valuable waterfront, is dependent upon one city fireboat, and has no tugboats equipped with effective fire apparatus. New York and Norfolk are particularly well provided with tug protection, and Philadelphia and Baltimore moderately so. Practically no attempt has been made by tug owners in the other cities mentioned to take advantage of the possibilities of this type of fire protection.

CONTRACT FOR DOCK.

The San Francisco Bridge Co., of San Francisco, Cal., has been awarded contract for building the transport dock at Fort Mason, in San Francisco, at a cost of over $1,000,000. The next lowest bidder was the American Construction Co., of San Francisco. The proposal contemplates the construction of wharves proper, seawall, dredging and sheds. The successful bidder agrees to do the entire work for $1,248,000. The sum of $1,500,000 is available for improvements at Fort Mason, of which about $250,000 will be devoted to the construction of warehouses, for which proposals will be asked later.

THE USE OF LIME IN THE MODERN MARINE HIGH PRESSURE BOILER.

The recent great developments which have taken place in the use of H. P. steam afloat, and the consequent increase in importance of the generator—requiring in its manufacture high tensile steel and the best design and workmanship—call for a more scientific and careful treatment of the modern marine boiler than is usually given.

The increase of pressure has greatly augmented the powers of the deleterious agents carried in by the feed water or produced in the boiler during working.

Acids, such as oleic, also free air and the gaseous carbon dioxide and oxygen, are more readily generated or liberated under modern high-pressure conditions, and are increasingly more destructive than they were in the boilers in use ten or fifteen years ago. Taking into consideration the increased cost of the modern boiler, in which the design, material and workmanship must be the best obtainable, especially in a boiler of the water-tube type, all the knowledge of the marine engineer, as well as any suitable appliances of modern science and invention, should be requisitioned in the difficult task of preserving and keeping in efficient working order the H. P. boilers entrusted to his care.

The use of an alkali as a preservative and preventative of deterioration in marine boilers has always been recognized, but only in recent years has the use of such progressed from the occasional and "guess-work" stage to that of a regular daily routine having a definite position in the care of all modern marine boiler batteries, where H. P. steam has made oil and air enemies to be dreaded.

Two alkalies stand out pre-eminently as "boiler medicines" afloat—in fact, they are the only two which can be used—lime (Ca.O) and soda ($Na_2 CO_3$).

Soda is now seldom used for boiler work, except in very minute quantities, as it causes priming, and injury to all joints not made of red lead—and even these are not immune if a soda solution is long in contact with them.

Soda also forms a soapy-like substance with any oil in the boiler, and as this mixture very often sticks more firmly to the shell than the original grease, the prevention, in this case, is worse than the disease.

Nevertheless, soda is useful in a boiler which is being let out, previously to being cleaned, if it be mixed with lime and fed in cautiously, as will be described later on.

Lime is now recognized as the most efficient and trustworthy agent in preventing the inroads of the harmful lime salts found in sea water and some fresh shore waters, the acids liberated from the various oils that find their way into the boiler, and the free gases carried in by the feed water or evolved in the boiler.

The old method of using lime and soda by putting a solution in the feed tank has little to recommend it save its cheapness and ease.

In fact it is a decidedly harmful practice.

In the condenser, soda especially only tends to clean out the oil and dirt, and these, as often as not, are conveyed to the one unfortunate boiler that is requiring at that moment—and getting, it is hoped, the most feed. Soda used in a condenser also frees lumps of oil and grease, which cause the air pump valves to stick and so injure the vacuum.

Lime behaves better in the condenser as it finds its way to the feed tank without disturbing the deposits of grease.

In any case, lime or soda put directly into the condenser or feed tank—whilst useful as a cleaning agent for the feed tank or condenser—generally finds its way into the boiler that is feeding at the time, in far too strong a solution and tends to make that boiler prime, besides discoloring its gage glasses.

The use of lime in marine boilers must be considered under two heads:

First, as a preservative of the surfaces of a boiler with which in a solution it is in contact when standing full, partially full or working.

Secondly, as the neutralizer of the injurious acids and gases which may find their way into the boiler through the feed or may be generated in the boiler where working.

(1) As a preservative.

When a boiler is pumped up from empty to full, lime is usually put in, in sufficient quantities to, at least, saturate the filling water. This is usually done by placing a quantity of milk of lime in the boiler and then pumping up to about 20 to 50 lbs. pressure to expel all air. This method is not to be recommended, as the circulation in a cold boiler is practically nil, and consequently when the boiler is partially full the mixing of the water and lime decreases, the inrushing water being the only stirring agent; thus intimate mixing of the water and the lime can hardly take place, and complete saturation of the water cannot be relied on as a certainty. This more especially applies to the top of the boiler or upper drum, where saturation is most necessary, as all air and gases accumulate there. The better method is to have the lime regularly fed into the pumping-up water, as a much more intimate mixture of the lime and water takes place in the feed pipe and pump, and the whole mass of the water contained in the boiler is properly saturated.

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The quantity of lime required to saturate water varies with the temperature of the water—the quantity decreasing as the temperature increases.

Three pounds of lime is required per ton of distilled water, when the temperature is 60° to 70° F., and one and a half pounds when the temperature has risen to 212° F.

A boiler which is to stand for any length of time requires at least three pounds of lime per ton of contained water—if distilled; more than this is not required, as the surplus settles to the bottom and may choke or injure the faces of the running-down valves.

Half an ounce of caustic soda (NaHO) per ton of water is used by some marine engineers, as it is believed to assist the water to absorb the lime and prevent any salts of lime forming a hard deposit on the shell or tubes. It certainly assists in rendering the water alkaline and can do no harm.

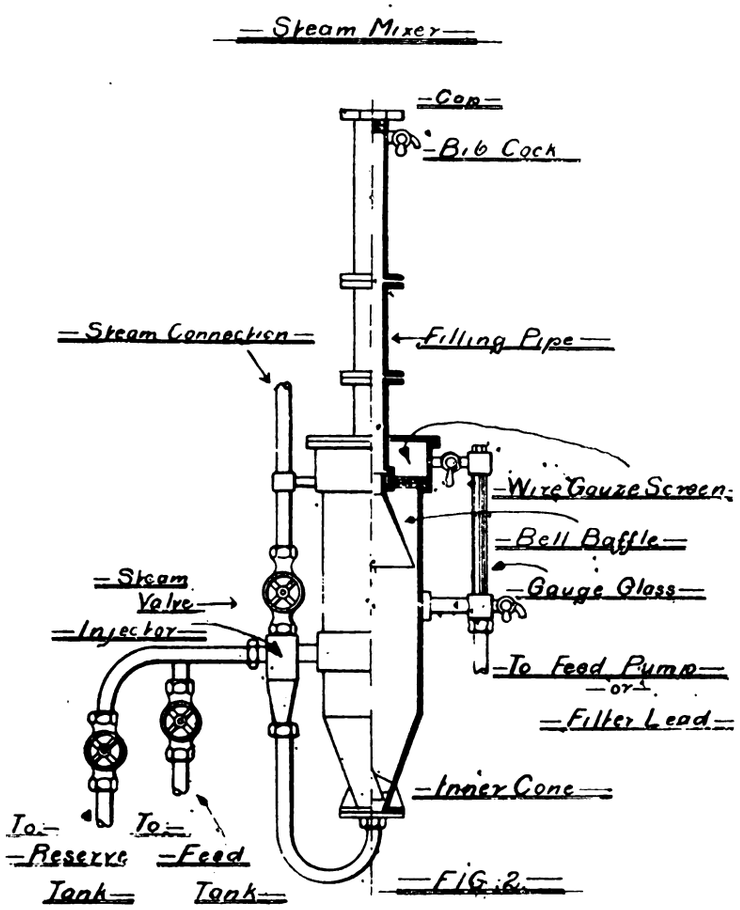
Boilers that are pumped up to working height and which will shortly be in action, do not require more than one and a half pounds of lime per ton of water and about a quarter of an ounce of caustic soda per ton of water if fancied.

These quantities of lime are simply preservative, and are not intended to kill the acids and gases introduced by the feed water. These must be dealt with separately and in another manner.

(2) Lime as a preventative.

Lime as a preventative neutralizes the oil and fatty matter in the feed water and assists to render innoxious the oxygen and CO_2 held in suspension in the feed and make-up feed water.

The dangerous oils and gases, which, when introduced into the boiler, do so much damage, are always found in the feed water in very minute particles; the oil, as a rule, in the ordinary feed water, coming from the condenser, the air and gases in the make-up feed. Air is very often introduced by the ordinary feed having a fall from the air pump discharge before it reaches the feed tank level as shown in Fig. 1.



Lime and oil have a mechanical affinity and mix easily even when large quantities of water are present; so that if sufficient lime in solution be introduced into each ton of feed water, as it flows on its way to the feed pump it is intimately mixed with the oil-laden water before reaching the boilers and combines with the oily particles. When the particles of lime and oil "mix" the alkaline properties of the lime so neutralize the acid-forming tendencies of the oil, that even when the combined particles of oil and lime which miss being caught in the filter find their way into the boiler, no dangerous acid is formed from the neutralized oil-laden particles.

Practically the same process takes place with CO_2 and O when free in the feed or make-up feed water, only the more powerful chemical affinity, in this case, directs the movements of these particles.

Lime, to be of use as an oil killer, must be fed in very regularly, very constantly, and in very small quantities to the feed water. An ideal feed is a constant stream of chemically pure lime water, discharging into the feed water and mixing with it on its way to the filter or feed pump.

At present there are two mixers or tanks for this purpose. One is a tank using hydraulic pressure as the mixing agent, and the other is a tank using steam for the same purpose. The first, which is illustrated in Fig. 1, consists of a large, built-up tank of three-sixteenths of an inch plate, and varies from three to six feet in length, and from two to four feet in diameter, and is so placed that its top is above the level of the feed-tank overflow.

A manhole is provided in the top plate and is used for cleaning and lime-charging purposes.

A pipe is led from the discharge side of the feed pumps into the top of this tank.

In large installations a separate system of piping is led round the stokeholds, having a connection to each feed-pump discharge.

The discharge water from this pipe is directed towards the bottom of the tank, where it stirs up the lime. On one side near the top a tap is placed discharging into a funnel. This funnel is attached to a pipe which leads the mixture of lime and water to the feed tank, where the lime and feed water are mixed before proceeding to the feed pumps.

This is an extremely simple type of mixer, but, whereas it is a great improvement on the old method of putting the lime direct into the feed tank, it also has many disadvantages. (1) Power is lost, as the feed-pump pressure is utilized for mixing purposes, (2) the pressure of the feed-pump discharge rises as the boiler feed is checked, causing the mixing to be strongest when the feed required by the boiler is least, resulting in the greatest quantity of lime being given to the feed when the feed water is flowing most slowly and *vice versa*, the result being irregularity in the lime feed.

(3) The discharge water falling into a funnel is slightly aerated, thereby carrying air into the feed water.

(4) A long system of piping and several valves are required in a big ship or where several feed pumps are used.

(5) The bulkheads require to be pierced.

(6) The tank is large for its work,

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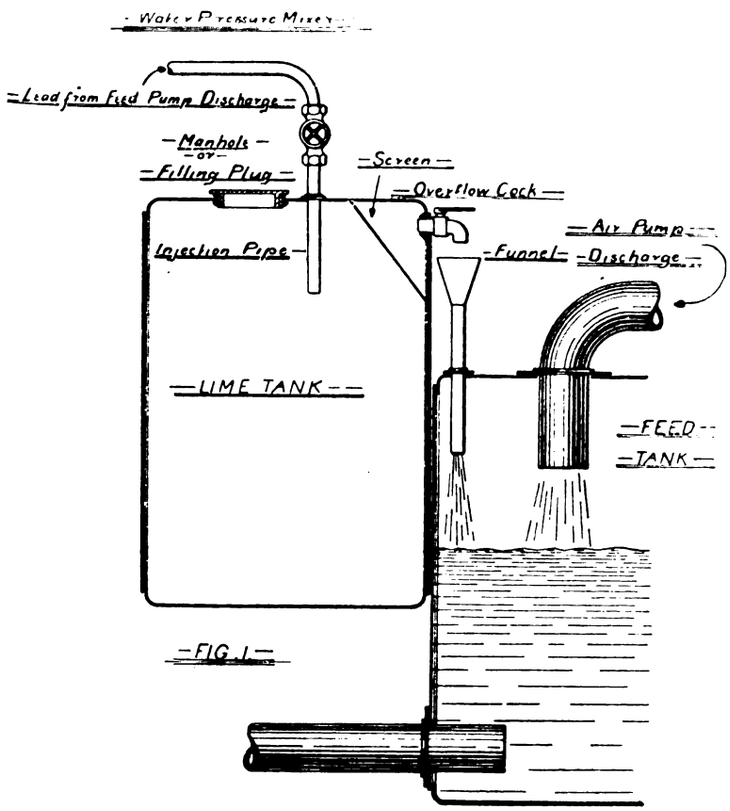
and consequently occupies a considerable amount of valuable space.

(7) The amount of lime feed is not easy to control.

(8) The weight of the mixer, when full, is considerable.

The other type—the steam mixer, which is illustrated in Fig. 2—is much smaller in size and consists of a cast-iron cylinder 2 ft. in length and 6 in. in internal diameter ⅜ in. in thickness, tapering at the bottom to a point, thus forming a cone.

This type of mixer has all the best features of the old pattern tank. It also acts as a feed heater, and helps to eliminate any free air or gases in the inflowing water, or which are freed in the mixing of the lime and water.



Lime (as a milk) is filled in through a pipe led well above the level of the feed-tank overflow. A bib cock is screwed in near the top of this pipe, also a plug to prevent dirt getting into the interior of the mixer.

The lime when poured into the filling pipe sinks to the bottom of the tank, and forms a silt around the inner cone. When the steam and water is turned on at the injector, the inflowing stream of hot water is forced through this silt. The water and lime are thoroughly mixed in the space provided below the bell-shaped baffle, about two-thirds of the way up the tank, all the gases and air expelled from the incoming water, by its increased temperature, are caught by the bell baffle and find their way up the filling pipe and out by the small bib cock at the top, provided for that purpose.

The lime water has to find its way past the edge of the bell baffle and then through the gauze wire screen. This baffle and screen break the direct flow of the water, and give all the larger particles of lime an opportunity to settle and dissolve. The lime water then proceeds through a large gage glass mounting to a pipe, leading to the filter or feed pump. A cock and funnel is, in some cases, fitted in lieu of the gage mounting, but, if simpler, is not so good, as the falling water tends to get slightly aerated, which is not to the advantage of the boilers.

The steam for injection can be led from any drain cock in the engine room. The steam used is in no way lost, as it is employed in heating the feed water.

It is recommended that the injector have two leads, one from the feed tank, the other from the reserve tank, so that all make-up feed may be taken through the lime tank, thereby partially freeing it from air and CO_2, and, at the same time, raising it in temperature before it proceeds to the feed pumps.

In a large ship, even when running at high power, all make-up feed water could be passed through this tank by means of the injector. This alone would lead to a considerable saving of fuel in addition to prolonging the life of the boilers, as one of the chief causes of pitting in boilers is now admitted to be the free air carried in by the make-up feed water.

This tank is very compact and light, and is extremely regular in its lime feed when properly set.

It is very adjustable, and can be set to feed with regularity from two lbs. to two cwts. of lime per 24 hours.

No lengths of piping or numerous valves are required in the stokeholds, and no piercing of the bulkhead is necessary with this type of mixer. It is also easily cleaned and filled and has no parts to get out of order.

The gage glass, through which the feed is discharged, allows the process to be watched and adjusted without aerating the lime water, as in a cock and funnel discharge; a bib cock is provided on the gage mounting for testing purposes.

No matter what type of mixer is used the chief things required in a mixer are:

(1) Regularity of feed.

(2) Ease of adjustment.

If a known quantity of lime can be regularly mixed with the feed water, each boiler then takes in a quantity of lime directly proportional to its feed—and as a consequence the impurities of that feed.

As the mixture of the lime and feed water takes place (or should take place) before the filter is reached, the particles of lime have an opportunity of assisting the filtering material to seize and retain the oil carried by the feed water.

The mechanical mixing of oil and lime also goes on inside the boiler, but is much less effective, as the dangerous acids are generated from the oil very shortly after it has reached the high temperature of the boiler water.

The same applies to the air and gases in the feed water. Both oil and gases, if possible, must be killed before reaching the boiler.

When the oil and lime particles in combination reach the boiler their dangerous properties of oil have apparently been killed by the union with the lime.

The condition of the interior of the boiler, when opened out, is a good check on how the lime feed has been regulated. If the oil has been in excess, a clayey oily deposit will be found on the shell and tubes of the boiler least exposed to the fire. If, on the other hand, the lime feed has been in excess, a heavy deposit of lime will be found on the shell and tubes. But if the proportions have been rightly adjusted, the lime and oil will deposit as a dry, clayey mass along the water line and surfaces of the boiler which first cool. The rest of the shell and tubes, in contact with the lime-charged water, will have a very light deposit of lime, almost as if they had been frosted or powdered with it.

These deposits of dirty, clayey lime and

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clean lime, are easily removed and will brush off as a dust, forming a striking contrast to the difficulty encountered in removing the grease and dirt from the shell and tubes of a boiler which has not been treated with a lime-saturated feed.

A lime-feed is especially necessary. The feed must be constant, regular and in very small quantities. Lime put in the boiler before closing up has in no way the same effect, and only slightly prevents the deposit of oil and grease and the generation of dangerous acids; it also to a much greater extent chokes and discolors the gage glasses.

Lime before closing up is only useful as a preservative to the shell of the boiler, by rendering the water alkaline. With regard to the use of lime in the feed, the important question arises as to what quantities should be used.

There are several ways of measuring the quantities required:

(1) By H. P. developed.

(2) By the number of tons of feed water used per 24 hours.

(3) By the alkalinity test.

(4) By the number of square feet of internal boiler surface.

(5) By the number of tons of water in the boiler at working height and when full.

The alkalinity test is, of course, but a check on the others, and is only useful as a means of knowing when to commence and when to leave off using lime.

The number of tons of water in the boiler is the only guide for the quantities of lime to be used when preparing a boiler for steaming, or when pumping up to full from empty. For this the general rule is 3 lbs. of lime per ton of distilled water, if the boiler is going to stand, and 1½ lbs. if it will shortly be steaming.

The number of square feet of internal boiler surface is of little use as a guide, except for a standing boiler, and the quantities given above for saturation apply also in this case.

The number of tons of water evaporated per 24 hours is the surest means of gaging the necessary amount of lime feed, but the lime feed for auxiliary and main engine work must be different, as in all ships the auxiliary machinery is responsible for most of the oil in the feed water. As the water evaporated is directly proportional to the coal burnt, the number of tons of the latter is perhaps the readiest guide.

When the boilers are working on the main engines, they are, as a rule, also on the auxiliary machinery, and the extra amount of oil supplied by the auxiliary machinery is so distributed over the increased number of boilers as to be practically negligible. The increased efficiency of the steam when on the main engines, and consequently the less coal burnt per ton of water evaporated, must also be considered in this matter. So that in practice only two proportions of lime per ton of coal burnt may be considered:

(1) For boilers on auxiliary work only.

(2) For boilers on main and auxiliary work combined.

Under modern conditions of marine engineering, the amount of oil in emulsion per ton of feed water is very small, and the amount of lime required is small in proportion—but to be effective must be fed in very regularly and in very small quantities.

The following rules are based on the assumption that one ton of coal evaporates 10 tons of water.

Boilers on auxiliary work only require about three ounces of lime per ton of coal burnt, to kill the oil in emulsion and neutralize as far as possible all free gases.

Boilers working on main and auxiliary machinery combined require 1½ to 2 oz. of lime per ton of coal burnt.

These quantities assume that the boilers are already charged to at least 1½ lbs. of lime per ton of contained water.

In either case reduce the lime to one oz. per ton of coal, when the boiler gives a very sharp reaction to the litmus test.

Scum about 1 to 2 in. in the gage glass and blow out another one inch when the boilers have received 1½ to 2 lbs. of lime per ton of contained water through the feed. The scumming and blowing out should only be done when the boilers are working easily.

If carefully applied these rules should keep the boilers in good condition.

When W. T. boilers are being forced, the lime feed should be eased or altogether ceased, to prevent the boilers priming.

Always give the boilers a good scumming and blowing out when finishing with the main engines, and fires are dying out. This is best done when steam has fallen to between 50 and 20 lbs. pressure.

A boiler which is shortly to be cleaned and is working easily may receive a special "finishing" or cleaning mixture, made of one part soda and two parts lime. Eight ounces of this mixture per water in the boiler is sufficient. It should be fed in gradually at the rate of not more than 1 lb. per hour. As a boiler in this condition will not stand any forcing, this mixture should be the last thing it receives before the fires are dying out, and it should be well scummed when pressure has fallen to 30-50 lbs. The water should be run into the bilge as soon as possible after the boiler is cold, and the boiler thoroughly cleaned before again using.

As regards small tube boilers special attention must be paid to the lime feed.

Lime, in excess, may easily cause priming in small tube boilers, especially in some classes of them. This necessitates very careful adjustment of the lime mixer. These boilers, when subject to forcing, should have not more than one ounce of lime, fed in regularly and well diluted, per ton of coal. It should not be put into the mixer in too great bulk. The mixer should be changed at least once every eight hours, or every four hours if too much labor is not involved.

A small (or in fact any) W. T. boiler may prime on lime being first introduced into the feed water. This, as a rule, only occurs when the lime is put into the feed in too great a quantity at a time. A boiler often primes on the slightest change of density in its feed. But after a short time it gets "used" to the slight increase, and the priming ceases. The feed may then be maintained at the increased density, without any further protest on the part of the boiler.

The use of lime—especially in excess—is liable to produce discoloration of the gage glasses.

It will not be amiss here to give the method usually used to clean a discolored glass, also to hint that it may be practically overcome by a regular and constant lime feed in small quantities.

When discoloration has taken place "boiling out" the discolored glass with vinegar or a weak solution of some handy acid, such as muriatic (spirits of salt) will remedy this. The procedure is to close the steam and water cocks and then drain the glass and close the drain cock. The top plug is then removed, and the glass is cautiously three parts filled with vinegar or a weak acid solution. The plug should then be replaced and the water cock cautiously opened, followed shortly after by the steam cock. Allow the solution to boil for a few minutes, then drain and blow through in the ordinary manner. This should leave the glass clear. It is important that this should only be done by an experienced and careful person, as the work involves the risk of a severe scalding.

Litmus is the recognized test for alkalinity.

A well-fed boiler should always give a sharp reaction to litmus, but when a sharp clear blue is immediately obtained, ease the lime feed to one ounce per ton of coal, or even less, as additional lime will only cause the glasses to discolor.

Experience with litmus will enable an engineer to judge exactly how his boilers are working, and so to regulate the lime feed as to assure the good condition of the boiler shell and tubes, and facilitate the cleaning of the boilers when opened out.

A much more delicate test for alkalinity is phenolphthaline and, where available, it will be found very useful as an alkalinity test for the feed water.

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Water, drawn from the feed pump, should give a delicate red ring to a drop of phenolphthaline, but should in no way affect litmus paper.

This is an almost ideal condition of the feed water, and should in practice be obtained—if the lime mixer is working properly.

It is also well to recollect that lime and soda have distinct reactions with silver nitrate ($AgNO_3$) and tend to confuse a casual observer testing for salt (NA.CL.).

Soda gives a dark brown precipitate with $AgNO_3$, lime a light brown, salt a dead white. Thus lime or soda may not only be confused with, but may even conceal the presence of salt.

Lime also gives a rise of density in the hydrometer test varying from 0.007 to 0.008 at 200° F. per pound of lime in each ton of distilled boiling water. This is taking the density of sea water as 10.

In conclusion, a moderate use of lime, with the aid of a good lime mixer, can be relied upon to save a marine engineer in charge of a battery of boilers, whether W. T. or Scotch, an endless amount of worry and trouble with regard to their cleaning, pitting and general working conditions.

Secretary of the Navy Metcalf has approved the report of the court of inquiry appointed to investigate the grounding of the cruiser Colorado on Liplip Point, Puget Sound, Aug. 20. The report exonerates the officers, Capt. Underwood, commander; Lieut. Comdr. Tarbox, navigator, and Lieut. Comdr. T. S. Wilson, executive officer. The report states that the accident was unavoidable because of a fog and incomplete soundings of the channel. The Colorado was not seriously injured and was soon repaired at the navy yard at Bremerton, Wash., but she was unable to accompany the fleet around the world. A letter has been sent to Secretary Straus of the department of commerce and labor urging that steps be taken to chart the channel where the accident occurred more thoroughly.

The navy department is about to erect a wireless station in Prince William Sound, Alaska. It will be about 500 miles from the military wireless station at Fort Gibbon, which is now being installed, and will form the connecting link between that station and the naval wireless station at North Head, Wash. The government will then be able to maintain a wireless service up the Pacific coast to the Alaskan station, which forms part of the Alaska military wireless telegraph system.

FERTILITY OF RESOURCE IN THE ENGINE ROOM.*

BY J. G. HAWTHORN.

A very eminent engineer, one of the most beloved members of our profession, the late John Macfarlane Gray, once said that "breakdowns at sea were providential ways of educating marine engineers," and perhaps that sentence might form a text for the following remarks. I propose that we shall imagine certain break-downs to happen in the case of an ordinary marine triple-expansion engine, and see how best to get over the difficulties. I shall not specify any particular kind of engine, neither shall I expect any reader to say "we could not do that on our ship, we have not the same facilities," but I should like to put before you a few general hints as to what might be done if certain things happen. Whenever anything goes wrong it is the engineer's duty at all times to look for the symptoms, and from them to diagnose the fault.

Commencing with that bugbear of the engineer's existence, namely, the engines bringing up suddenly, let us imagine a case where the engines are brought up very quickly to within three or four revolutions from full speed. The first thing I would suggest doing is to prove that the stop valves and throttle valve are in good working order, by opening the drains, and blowing the steam through. A clean blow through proves whether or not these valves are right—they have been known to have the seats lift, or the spindle to strip. Let us suppose we have the steam blowing through all right; our next duty should be to reverse the link motion and see if the engines will go astern. Should they not go astern, we may safely assume that the slide valve is adrift on the spindle; but should the engine reverse and go astern, we then know that it is in ahead gear where the fault lies, and we should trace it from valve spindle down to eccentric sheave.

We may find the rod bent, due to an overheated strap; thus the valve would not probably reach high enough in its travel to give a free exhaust from the top of the piston (taking a direct-acting valve) and closing again so soon would thereby increase the compression on the top of the piston so that the engine could not get over the top center; or we may find the key of the eccentric sheared off, with the possibility of the shaft revolving inside the sheave. Should the high pressure valve become injured beyond repair, I would then suggest, having removed the broken parts, to shut down the engine stop valve till the pressure by the intermediate gauge showed about 80 to 90 lb., and go on working as a compound engine. I would also suggest that the piston rod and connecting rod of the high pressure engine be removed, or the connecting rod only be taken down together with the eccentric rods, putting on a stop plate to hold up high pressure piston and rod. I also suggest that this should be adopted in the case of a broken piston rod, connecting rod, or shaft.

Regarding the pressure carried, I should say that it would be better to maintain the full boiler pressure, and by wire drawing through the engine room stop valve to reduce the pressure; this would entail an easier time for the boilers; besides, the throttling of the steam would tend towards superheating. I would also suggest that links be kept in full gear. In the event of the high pressure ahead eccentric rod being broken, we may resort to slinging up the link at the astern end, substituting the astern way rod for the ahead rod, but great care should be taken to see that the valve setting is the same and the rods are of the same length; this would enable the engines to still be maintained triple expansion, but we could only go the one way, so that upon approaching our port of destination we could then remove the ahead rod, taking out the valve, working the engine as a compound engine for maneuvering purposes.

OTHER FAULTS DIAGNOSED.

Coming now to the intermediate engine: Should the valve be broken, we have no other choice than to exhaust from the high pressure engine round to the low pressure engine; or, should the piston be so fractured that we could by no means repair the same, we should have to do the same thing. It is interesting to see for a moment what would be the result of this. In the first place, when the high pressure engine opened for exhaust there would be a considerable drop of pressure in passing round to the low pressure valve box; and we should probably find that the high pressure engine had considerably increased the horsepower by the reduction of back pressure. Let us presume a case, steam entering the high pressure at 180 lb. by gage, cutting off at or about one-half stroke, giving a terminal pressure of about 75 lb. by

*From a paper read before the Institute of Marine Engineers.

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gage in high pressure cylinder. Upon opening the exhaust at about eight-tenths of the stroke, I should then expect the pressure to fall, say, to about 20 lb. on the low pressure gage, a heavy knocking action being experienced in the high pressure engine through the want of compression. And here I would now suggest that if we can link up the low pressure engine only, to do so and so force up the pressure in the low pressure valve box, this would also tend to equalize the horsepower. I am presuming that the pump levers are driven by low pressure engine. Should the levers be on the intermediate engine, I suggest that the intermediate engine be run idle in order to keep the pumps going. Should an intermediate shaft be broken or flawed, if there is no spare one at hand, I suggest that it be changed, if possible, for the high pressure, putting the flawed journal forward; and here I would say at all times it is better to rob the high pressure engine for the low pressure, and go on as before compounding, than to exhaust from high pressure to low pressure, and so avoiding the stresses set up in the shafting by the unequal turning moment.

Coming to the low pressure engine, in the case of any casualty happening here, it is more interesting still to see how we could meet the difficulty. First let us suppose that the slide valve is broken, then we shall have to exhaust from the intermediate pressure into the condenser, and if the levers are driven by the low pressure engine, drag the low pressure round idle in order to work the pumps. If the valve spindle or eccentric rods be broken, then, if possible, rob the high pressure engine and go on compound, or if the shaft shou'd be flawed, change, if possible, forward, remembering that the low pressure shaft has to transmit the horsepower of the three engines, and, therefore, there is three times the stress in that shaft as in the high pressure shaft.

I have an instance of a low pressure piston rod being broken short off at the crosshead. The engineers set to work, and, drawing the slide valve, removed the broken rod and piston, blocking the steam ports, and dragging round the connecting rod with their crosshead attached, worked their pumps, thus keeping their engine a surface condensing engine. I cannot impress too much upon you that at all times, with modern marine engines of high pressures, it is better to keep the condenser surface condensing, and so obtain fresh water for the boilers, sacrificing anything in the shape of vacuum, etc., to obtain it; and I think it would not be out of place here to recount an actual breakdown that occurred to a large vessel bound for the colonies. Falling into bad weather, the engine raced heavily for some two or three days, and eventually one of the top end bolts gave way, and the engine, so to speak, took a long stroke, or, in other words, the piston and piston rod left the connecting rod, striking the cover and fracturing it, splitting the cylinder, breaking the caps of the rocking shaft of the levers, doubling up the levers and generally smashing up the pumps. Here their salvation lay in having a separate independent circulating pump. The first thing they did was to lift the low pressure valve box cover and exhaust from the intermediate pressure into the atmosphere, putting cold sea water into the boiler, while patching the deduction pipe. As soon as they could exhaust into the condenser they did so, and by cutting a 4-in. hole in the bottom of the condenser and connecting the independent feed pump to it they managed to obtain fresh water for their boilers. On the passage home, they worked high and intermediate on to the condenser and dragged the low pressure connecting rod round with crosshead attached to work their levers and pumps, doing without the low pressure engine. They obtained fairly good results upon the passage home.

I would also tell you of how a knowledge of the early history of the engine came to the aid of engineers in a serious breakdown in an ordinary tramp steamer homeward bound across the bay in fine weather but with a heavy rolling sea. The boats had been cast adrift from their lashings in order to give them a coat of paint, when by some means the man at the wheel allowed the ship to fall off into the trough of the sea, and a big sea coming on board amidships lifted one of the boats and dropped it on to the skylights, which were of the old-fashioned wooden type. The skylights gave way, and the result of the accident was a broken low pressure cylinder cover. The engineer, having a knowledge of how Watt first moved in the development of the engine, determined to try and work the low pressure engine as an atmospheric engine. First they removed the broken cover, and, blocking the top steam port to prevent a loss of vacuum on the upstroke, they then cut off the bottom lap of the valve; and, putting the eccentric back till nearly at right angles to the crank, they set her away, carrying steam the whole length of the up stroke, exhausting at the end of the stroke into the condenser, the work of the downstroke being accomplished by the atmosphere. I should now like to bring before your notice several cases of how shafting has been repaired by engineers at sea with little or no tools at their command or material to work with.

In the first case great fertility of resource was shown, the shaft being fractured across the web. It was a built shaft, the sides of the web being parallel and the ends rounded, the fracture appearing straight across the web. The engineer casting about for something to make a strap with suddenly hit upon the novel expedient of removing a stay from the steam space of one of his single-ended boilers and bending it round the web. He then cut a plate out of one of his flooring plates, and putting three thicknesses of this plate across the web, firmly bolted it together, heating the strap up to a bright red before tightening up the nuts.

Here you see he had already the ends screwed and nuts to fit, going to slow with reduced pressure. The second case is where a short intermediate length of tunnel shafting fractured abaft the coupling, the fracture extending for 15 in. fore and aft. The diameter of the shaft was 12½ in., with eight 2½-in. coupling bolts in each coupling. Fortunately, it was fitted with a stern way collar against the aft main bearing in the tunnel, which prevented the shaft from running aft. The engineer's first thoughts were to sink three keys into the shaft and endeavor to make clips to go round them afterwards; but he abandoned this idea in favor of the following method of splicing the shaft. He first removed the bearing to the forward side of the coupling, packing it up with logs of wood and shoring it from each side of the tunnel. Removing four coupling bolts from each coupling, he then utilized the steel towing or mooring hawser in the following manner: Passing the hawser, after belaying it on the forward side of the coupling, fore and aft through the holes he had removed the bolts from, until he had five ply of the hawser through each hole, giving them 20 ply in all, to take up the torsion, then strapping round the shaft till made up solid with the couplings, he informed the captain he would not risk reversing the engine, but went away ahead, gradually

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working his speed up to nearly full speed. Many readers will no doubt remember several other cases of broken shafts brought before the notice of the institute from time to time.

Passing on to the condenser and pumps there is no part of our engines that we can diagnose faults from symptoms so readily. Let us suppose upon entering the engine room we find the vacuum gage going back to 18 in. or 20 in. vacuum, and the engine slowly down. Our first duty should be to ascertain that the circulating pump is doing its duty correctly by getting the temperature of the circulating water. If very cold, then I should assume that one of the division plates in water way of the condensers had given way, and the water was not going through the tubes; this would give a cold discharge and loss of vacuum, with one end of the condenser fairly hot.

Again, say we find the temperature of the discharge hotter than normal but feeding going on regularly. I should at once say there was something wrong with the circulating pump. We should then set to work and find the fault. Should the air pump give out, what are the first indications of it going wrong? It would show a loss of vacuum, an intermittent feeding, with occasionally overflowing from the hot well. We should experience little or no trouble with leaky foot valves if the head and bucket were tight and in good working order. Should the foot valve or valves give out and air is being admitted under the head valve for cushioning purposes, I suggest that the air valve be shut down so that the pump will make better vacuum on the downstroke than in the condenser. If the head valves are giving out, I suggest that the foot valves be robbed if possible to supply the head valves. Should the bucket become broken I would suggest making a wooden bucket and packing it in the ordinary manner with manilla rope.

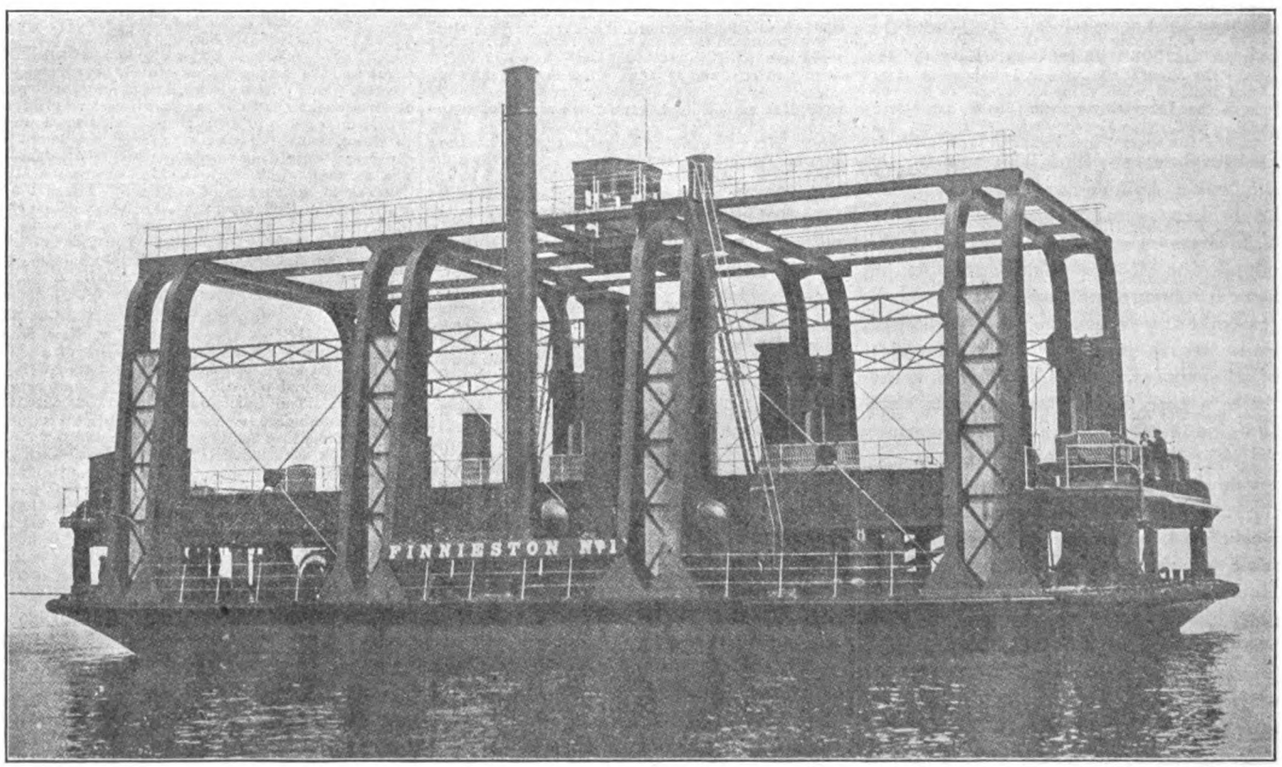
Ferry Steamer Finnieston.

There is herewith illustrated the new elevating vehicular ferry-steamer Finnieston No. 1, recently constructed by Messrs. Ferguson Bros., ship builders and engineers, Port Glasgow, for the trustees of the Clyde Navigation, under the direction of G. H. Baxter, mechanical engineer. The vessel was launched with machinery aboard and steam up; the illustration is from a photograph taken immediately after the launch.

This is the second ferry of this type built for the Clyde trust. The first was constructed in 1890. It has since done good service, and justified the building of this second and larger vessel which will be used at the same point—at Finneston, about a mile west of Glasgow bridge, while the old ferry will be transferred to Pointhouse, a mile further west, where a floating bridge has hitherto served for vehicular traffic between the suburban burghs of Patrick and Govan. We give in parallel columns the dimensions of the new and the old boats:

	"Finnieston" of 1908.	"Finnieston" of 1890.
Length	104 ft.	80 ft.
Breadth	45 ft.	43 ft.
Depth, molded	12 ft. 6 in.	12 ft.
Vertical range of elevating platform....	17 ft.	14 ft.
Capacity of vehicular platform	16 loaded lorries	8 loaded lorries

The elevating platform, which carries the vehicles, has a range of 17 ft., and is carried on eight double-



THE ELEVATING FERRY STEAMER FINNIESTON FOR GLASGOW HARBOR.

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threaded buttress screws of forged steel; the screws are hung on collar bearings in cast steel brackets, which are supported by the framing-legs. The platform is built up of II girders, closely pitched, connected at the ends to massive-built steel girders on each side of the vessel. The supporting screws are fitted with worm-wheels of special material, gearing at the lower ends with forged steel worms, working in oil baths. A separate triple-expansion three-crank engine is fitted for the purpose of raising or lowering the main platform. This engine is of the inverted type and connects to the worms by machine-cut bevel and spur-gearing of cast steel; automatic gear is fitted on this engine to prevent the platform being raised or lowered beyond its intended travel. A brass indexed telltale is also fitted in a prominent position in the engine room to show in feet and inches the position of the platform.

The lower or main deck is of steel-plating and has no projections above 10 in., to enable the elevating platform to come to its lowest level.

The main propelling engines are of the vertical three-crank triple-expansion type, each egine driving two propellers, one forward and one aft; two thrust-blocks are fitted on each line of shafting.

The engines are controlled from the house on the top of the framing by balanced rods, the latter actuating the steam valves on the direct-acting steam and hydraulic reversing engines. There are no rudders, the vessel being maneuvered entirely by the propelling machinery. In the controling-house the two reversing handles are situated one on each side of the steersman's position. Two Chadburn's direction telltales and tachometers are provided and fixed in this house, giving the number of revolutions and direction of the propelling engines. Chadburn's telegraphs to main and elevating engines are also fitted; the former are only intended for use in case of emergency.

Steam is provided by two return-tube marine boilers, having a working pressure of 160 lb. per sq. in. The main condenser is separate from the main engines and is fitted with two of Baker's exhaust-steam purifiers. The air pumps are independent and steam-driven by two-crank compound engines, and are in duplicate, one set being kept as a standby. This also applies to the independent centrifugal circulating pumps. Electric light is fitted throughout.

The boiler feeding is effected by Weir's automatic float tank pumps, the feed water passing through a Weir heater and Harris filter before entering the boilers. Cameron's pump is fitted for bilge and wash-deck service.

The vessel throughout is of massive design, all parts having been carefully constructed for their respective purposes. The platform is intended to carry 16 loaded lorries, but with a mixed cargo as many as 20 vehicles can be accommodated on board.

After successfully passing through her stability and steaming tests the vessel was put to work on her station and has given entire satisfaction. The vessel was built to British Corporation Survey, and has a board of trade certificate.—*Engineer,* London.

Board of Trade Rules for Steel Boiler Materials.

The following circular on "The Manufacture and Testing of Steel Material Intended for Boilers and Machinery under Board of Trade Survey" has been issued by the Marine Department of the Board of Trade:

1. *Introduction.*—The board have had under consideration the reports issued by the Engineering Standards Committee relating to structural steel for marine boilers, ingot steel forgings for marine purposes, and steel castings for marine purposes; and have prepared the following amended instructions for the guidance of their surveyors.

2. *Date of Enforcement.*—These instructions will come in force on Aug. 1, 1908, but in any case in which engineers, boilermakers, or steel manufacturers desire it, they may be adopted at once.

GENERAL CONDITIONS.

3. *Process of Manufacture.*—All steel intended for use in the construction of boilers and for forgings shall be made by the open-hearth process. Boiler plates shall be of acid quality; but the other portions of boilers and forgings may be made of either acid or basic steel. In the case of castings, the steel may be made by any process which has been approved by the Board of Trade.

4. *Freedom from Defects and Treatment of Test Pieces.*—The finished material shall be sound and free from cracks, surface flaws, and laminations. No hammer dressing, patching, burning, or electric welding is permissible, and if any material is annealed or otherwise heat-treated, the test pieces shall be similarly and simultaneously treated with the material before they are tested. No further heating or forging of the specimens may be done, and all the necessary preparation shall be made in a machine.

5. *Selection of Test Pieces.*—All the test pieces required shall be selected by the surveyor, and except where otherwise specified, the tests shall be made in his presence at the place of manufacture, and before the dispatch of the material; and the stamping of test pieces shall be done after all the heating or annealing is completed.

6. *Number of Tests in Certain Cases.*—When a number of articles are cut from one plate, bar, or forging, the number of tests required shall be the same as that required from the original piece, provided the articles have not been further heated or forged, and can be identified as having formed part of the original piece.

When a number of small forgings are made from the same ingot, or a number of small castings from the same charge of steel, the full number of tests specified herein need not be made; tensile and bending tests at the rate of one for every four articles will, as a rule, in such cases be sufficient.

7. *Duplicate Tests.*—Should either a tensile or a bend test fail to fulfil the test requirements, and the surveyor considers that the test piece does not fairly represent the quality of the material, two duplicate specimens may, if the maker wishes, be tested; and if the results obtained from both are satisfactory, the quality of the article shall be judged therefrom and not from the original test which failed. If, however, either of the duplicate test fails, the article or articles represented shall be rejected.

8. *Stamping of Material.*—Every article shall be stamped with a number or identification marks such that the charge of steel from which it was made can be readily identified. In addition to this, plates and bars shall be stamped with the maker's name or trade mark, and plates with results of any test which are made from them.

9. *Material Proving Unsatisfactory to be Rejected.*—In the event of any material proving unsatisfactory in the course of working or machining, it shall be rejected notwithstanding any previous certification of satisfactory testing.

10. *Special Instructions.*—The special instructions contained in Circular 1382 respecting steel material for which certi-

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fied copies of the results of the tests are required, those respecting the testing of steel tubes and pipes contained in circular 1403, and those regarding boilers for which special certificates are required, remain in force as heretofore.

11. *Standard Test Pieces.*—The forms and dimensions of test pieces shall be shown in the illustrations.

The gage length and the parallel portion of the test pieces shall be as shown. The form of the ends to be as required, in order to suit the various methods employed for gripping the test piece.

12. *Bending Test.*—The specimens sheared from plates, angle bars, and tee bars, for bending tests, shall not be less than 1½ in. wide; but for small bars the whole section may be used. The bending specimens of round bars shall be of the full diameter of the bars, as rolled, and the bending tests of forgings and castings shall be made with rectangular test pieces 1 in. wide by ¾ in. thick, which shall be machined to size, and have the corners rounded to a radius of 1/16 in.; they shall be bent over their thinner section.

STEEL FOR USE IN BOILERS.

13. *General.*—The following instructions refer to steel of ordinary mild quality. Where special or high tensile steel is used, the requirements specified by the Board in each case shall be adhered to.

Should any tensile test piece break at a point outside the middle half of its gage length, the test may, at the maker's option and with the surveyor's approval, be discarded, and another test made from the same plate or bar.

PLATES.

14. *Number of tests.*—A tensile and a bending test shall be taken from each plate, as rolled; but, when the weight of the plate exceeds 2½ tons, a tensile and bending test shall be taken from each end. Bending tests only need, however, be made from plates for which a greater stress than is allowed for iron is not wished. The bending tests of plates not intended to be worked in the fire or exposed to flame may be made with strips in the same condition as the plates—those from other plates should be made with strips which have been tempered.

15. *Preparation of Test Specimens.*—Test specimens may be cut from the plates, either lengthwise or crosswise, and, whenever practicable, the rolled surfaces shall be retained on two opposite sides of the test piece.

In all cold and temper bend tests of samples 0.5 in. in thickness and above, the rough edge caused by shearing may be removed by filing or grinding; and samples 1 in. in thickness and above may have the edges machined.

16. *Temper Bends.*—For temper bends the samples should be heated to a blood red and quenched in water at a temperature not exceeding 80 degs. F.

17. *Tensile Strength and Elongation of Plates.*—The tensile strength of plates not intended to be worked in the fire or exposed to flame, for which special limits have not been sanctioned, shall be between 27 and 32 tons per sq. in.—that of other plates, from 26 to 30 tons per sq. in. The elongation shall not be less than 20 per cent in a length of 8 in. for material 0.375 in. in thickness and upwards which is required to have a tensile strength of 27 to 32 tons per sq. in., and not less than 23 per cent if the tensile strength is required to be between 26 and 30 tons per sq. in. For material under 0.375 in. in thickness, the elongation may be reduced; but for each eighth of an inch of diminution in thickness, the reduction shall not be more than 3 per cent below the elongations named above.

18. *Bend Tests.*—Bending test pieces shall withstand being bent, without fracture, until the sides are parallel at a distance apart of not more than three times the thickness of the specimen.

19. *Witnessing of Tests by Surveyor.*—It is very desirable that the surveyor should witness the whole of these tests; but, in the case of plates made from steel manufactured by any of the makers whose names are given in clause 106 of the regulations, he need only select and witness from one in four of the plates of each thickness, unless the weight of the plate is over 2½ tons, or special limits of strength, or in the case of shell plates a minimum tensile strength exceeding 27 tons is required; in which cases the surveyor should see the tests made from all the plates.

20. *Tensile Strength to be Used in Calculations.*—In ascertaining the strength of the shells of cylindrical boilers, the actual minimum tensile strength of the plates, as found by the tests, may, as heretofore, be used in making the calculations to determine the working pressure.

ANGLE, RIVET, AND STAY BARS.

21. *Number of Tests.*—At least two tensile tests shall be taken from each charge of steel; but when the number of bars, as rolled, from one charge exceeds 15, an additional test shall be made from each further 15 bars or portion thereof. In round bars 1¾ in. diameter and under, the number given above shall, in each case, be 50 in place of 15.

A cold or a temper bend test shall be made from each angle or tee bar rolled, and a cold and a temper bend from every 15 stay bars, as rolled from each charge. No bending tests need be made from rivet bars.

22. *Tensile Strength and Elongation: Stays, Angles, and Tee Bars.*—The tensile strength of longitudinal stays, angles, and tee bars shall be between 27 and 32 tons per sq. in. with an elongation of not less than 20 per cent measured on the appropriate standard test piece—A or B. For bars for combustion chamber stays, the tensile strength shall be between 26 and 32 tons per sq. in., with an elongation of not less than 23 per cent measured on the standard test piece. But when stay bars are tested on a gage length of four times the diameter—test piece F—the elongations shall be 24 and 28 per cent respectively.

For tee or angle bars under 0.375 in. in thickness, the elongation may be 3 per cent below that specified for plates.

23. *Bend Tests.*—Bending test pieces of bars shall withstand being bent, without fracture, until the sides are parallel at a distance apart of not more than three times the thickness or diameter of the specimen.

24. *Rivet Bars.*—The tensile strength of rivet bars shall be between 26 and 30 tons per sq. in., with an elongation of not less than 25 per cent, measured on the standard test piece B, or 30 per cent if measured on test piece F.

RIVETS.

25. *Nature of Tests.*—A few rivets of each size shall be selected by the surveyor from the bulk, and shall be subjected to the following tests: (*a*) The rivet shanks to be bent cold and hammered until the two parts of the shank touch without fracture on the outside of the bend. (*b*) The rivet heads to be flattened while hot, until their diameter is two and a half times the diameter of the shank, without cracking at the edges.

26. *Tensile Tests.*—A few check tensile tests of rivets shall also be made when the surveyor considers it necessary, and, in the case of boilers for which special certificates are required, a few tensile tests of the rivets of each size shall always, as heretofore, be made in addition to the above. The elongation shall, when practicable, be taken in a length of two and a half times the diameter of the prepared part; the tensile strength should be from 27 to 32 tons per sq. in., and the contraction of area about 60 per cent.

STEEL FORGINGS.

27. *General.*—The forgings shall be made from sound ingots, and not more than the lower two-thirds of the ingot may be utilized for forging. The sectional area of the body of the forging may not exceed one-fifth of the sectional area of the original ingot; and no part of the forging shall have more than two-thirds of the sectional area of the ingot. All ingot steel forgings shall, after completion, be thoroughly annealed at a uniform temperature; and, if any subsequent heating is done, the forging shall, if required by the surveyor, be again annealed.

28. *Number of Tests.*—At least one

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tensile and one bend test shall be taken from each forging; but if the weight exceeds 3 tons a tensile and a bending test shall be taken from each end.

29. *Preparation of Test Pieces.*—The test pieces shall be cut from a part of the forging of sectional dimensions not less than those of the body of the forging and shall be machined to size without further forging down. They shall be cut off until the annealing has been completed and they have, subsequent thereto, been stamped by the surveyor.

30. *Tensile Strength and Elongation.*—The tensile strength of steel forgings shall not exceed 40 tons per sq. in.; and the elongation, measured on the appropriate standard test piece C, D or E, shall not be less 17 per cent for 40-ton steel; and in no case may the sum of the tensile strength and the corresponding elongation be less than 57.

31. *Bend Tests.*—The bending test pieces must withstand being bent through an angle of 180 deg. without fracture, the internal radius of the bend being not greater than that specified below:

Maximum Specified Tensile Strength of Forging.	Internal Radius of Test Piece After Bending.
Up to 32 tons per square inch	¼ in.
Above 32 tons and up to 36 tons per square inch.....	⅜ in.
Above 36 tons and up to 40 tons per square inch.....	½ in.

STEEL CASTINGS.

32. *General.*—All steel castings shall be thoroughly annealed at a uniform temperature, and shall be allowed to cool down prior to removal from the annealing furnace; and if subsequently heated, with the surveyor's approval, shall again be similarly annealed, if required by the surveyor. Test pieces shall not be cut off until stamped by the surveyor, which shall not be done until the castings have been annealed.

33. *Number of Tests.*—No tests need be made from unimportant steel castings or from steel castings which are used for articles usually made of cast iron, if the scantlings are not materially reduced below what would be required if cast iron were used. All other steel castings shall be tested as follows: At least one tensile and one bending test shall be made from the castings from each charge; and, where a casting is made from more than one charge, at least four tensile and four bending tests shall be made from pieces cast as far apart as possible on the casting and as near the top and the bottom respectively as practicable. When more than one casting is made from one charge, at least one tensile and one bending test shall be made from the castings run from one common pouring head; but separate tests shall be made from each casting or set of castings run from each separate pouring head. Small castings may, however, be dealt with in accordance with the provisions of section 6.

34. *Tensile Strength and Elongation.*—The tensile strength may range from 26 to 40 tons per sq. in., with an elongation measured on the standard test piece C, D, or E of not less than 15 per cent. But if the castings are to be used for the more important pieces of machinery, such as pistons, etc., or for articles usually made of wrought material, the elongation must not be less than 20 per cent, where the corresponding tensile strength is between 26 and 35 tons per sq. in.

35. *Bend Tests.*—The bending test pieces must withstand being bent, without fracture, though an angle of 60 deg. if the tensile strength is between 35 and 40 tons per sq. in.; and, in the case of other castings, through an angle of 90 deg. But if they are required to be of the superior quality referred to above, the angle must not be less than 120 degs. The internal radius of the bend in each case may not be greater than 1 in.

36. *Repeal.*—These instructions supersede those contained in the following clauses of the regulations as to the survey of the hull, equipments, and machinery of steamships carrying passengers, 1905 edition—viz., 92, 93, 94 down to the words "shaping machine;" 95, 96, 97, from the words "The following proportion" to the words "in a length of 10 in.," in the fourth line on page 62; the four lines commencing with the words "The tensile strength of strips;" and from the words "The tensile strength of rivet bars" to the end of the paragraph.

37. *Circulation of Instructions.*—Surveyors are requested to bring these instructions to the notice of persons interested.

H. LLEWELLYN SMITH, Secretary,
WALTER J. HOWELL, Assistant Sec'y.

The Practical Proportioning of the Reaction Steam-Turbine.

(From *Engineering.*)

It has been generally known for some time past that many builders of the compound reaction steam-turbine do not in general attempt any very detailed analysis of the action of the steam as it passes through the blading, but determine the proportions necessary by certain simple formulae largely empirical in character. For example: a rule for deciding upon the number of rows of blades which has been very largely worked to is

$$s^2 n = \text{constant},$$

where s denotes the speed of the moving blades in feet per second, and n the number of rows of blades on the rotor; that is to say, half the number of stages.

There appears to be some difference in the practice of designers using this rule. Some take for s the speed of the blades at their roots; that is to say, the surface speed of the drum; while others denote by s the mean blade speed. The former practice is the simpler, but the latter is somewhat the more logical. The above rule has already been given in Mr. Sothern's excellent little work on the "Marine Steam-Turbine," but the method of using it is not very clearly explained. He states that the value of the constant is 1,500,000, and this figure agrees very well with the proportions actually adopted in marine practice. For example, the same author gives the following particulars of the blading of a cross-channel steamer, the turbines of which were designed to make 500 R. P. M.:

	H. P.	L. P.
Diameter of drum.....	48 in.	68 in.
Total number of rows of blades on rotor	48	48
Blade lengths...Group I.	1⅛ in.	1⅛ in.
Group II.	2 in.	2 in.
Group III.	2¾ in.	2¾ in.
Group IV.	4 in.	4 in.
Group V.		5½ in.
Group VI.		8 in.
Group VII.		8 in.
Group VIII.		8 in.

The surface speed of the drum is here 104.7 ft. per second. As there are two low-pressure turbines, the high-pressure is intended to do only one-third of the total work, and hence its rotor has only one-third the total number of rows of blades given by the formula. The constant here is 1,600,000. So that we have

$$n \times 107.4^2 = 1{,}600{,}000,$$

whence $n = 144$ nearly, one-third of which is 48, which is the actual figure. For the low-pressure turbine $s = 148.4$, whence

$$n = \frac{1{,}600{,}000}{(148.4)^2} = 72.73; \text{ say, } 72.$$

The low-pressure turbines are intended to do two-thirds the total work, and hence the actual number of rows provided is $2/3 \times 72 = 48$. It will be seen that the low pressure drum has a diameter equal to that of the high-pressure drum multiplied by $\sqrt{2}$. This rule for successive drum diameters is very commonly worked to both in marine and electric-light practice.

As another example of a marine turbine we give below the data for a ship having two high-pressure and two low-pressure turbines. Here the drum diameters are 68 in. and 92 in. respectively,

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which, it will be noted, form an exception to the rule above given. On the Mauretania, however, which has a similar arrangement of turbines, the drum diameters are 96 in. and 140 in., which agree very well with the rule that these should be in the ratio of 1 to $\sqrt{2}$.

		H. P.	L. P.
Diameter of drum		68 in.	92 in.
Total number of rows of blades on rotor		72	36
Blade lengths	Group I.	7/8 in.	3 3/8 in.
	Group II.	1 1/4 in.	5 1/2 in
	Group III.	1 3/4 in.	7 3/4 in.
	Group IV.	2 1/2 in.	11 in.
	Group V.	3 1/2 in.	11 in.
	Group VI.	5 in.	11 in.

At full power the turbines referred to in the above table made 330 R. P. M. Here the designer has apparently used for s the mean blade speed, and not that of the rotor surface. For the high-pressure turbine s is about 102 ft. per second.

Taking the constant as 1,500,000, we get for the number of rows of blades on the high-pressure rotor,

$$n = \frac{1{,}500{,}000}{102^2} = 144.2.$$

Since, however, this turbine is designed to do one-half the work, and not the total work, the number of rows of blades in it will be 72.

For the low-pressure turbine, $s = 143$ ft. per second, whence

$$n = \frac{1{,}500{,}000}{143^2} = 73.3; \text{ say, } 72.$$

As the low-pressure turbine does half the work only, the actual number of blades on the rotor will be 36.

It will be noticed that the blade heights, in both the turbines dealt with, increase in geometric progression, the common ratio being $\sqrt{2}$. This, again, is a purely empirical rule. It is based on the assumption that the steam in passing through the turbine expands 64 times in all, and that as the work done increases in arithmetical ratio, the volume increases in geometric ratio; that is to say, when one-quarter the total work has been done, the steam has expanded 2.8 times. When half the work is done, the steam has expanded eight times; and when three-quarters the work has been accomplished, the steam has expanded 22.4 times. This rule is often used when the stop-valve pressure does not exceed 150 lb. per square inch gage-pressure. For higher pressures, the assumption frequently made is that the steam expands 81 times. In this case, when one-quarter the work has been done, the steam volume is assumed to be three times its initial value; at half-work it is nine times its initial value; and at three-quarter work, 27 times its initial value. In the Carmania a smaller value was assumed for the total expansion, the common ratio of successive blade heights, being about 1.25.

This geometric rule for fixing successive blade heights is, as already stated, purely empirical. In general, at full load it makes the blades increase in height a little too fast at the high-pressure end, and a little too slowly for the remainder of the turbine. Since, however, the latter seldom works continuously at full load, this theoretical defect is possibly a positive advantage in practice. As the load diminishes, the total ratio of expansion decreases, owing to the wire-drawing of the steam at the entrance to the turbine. The velocity of the steam through the first rows of blades is, however, nearly constant at all loads, so that the same amount of work per pound of steam is done at all loads, practically the whole of the falling off being at the low-pressure end. If this is slightly contracted, as follows from the use of the geometric law above set forth, the relative loss here is less than would otherwise be the case. The fact that the admission pressure varies in direct proportion to the load on the turbine makes it impossible that the proportions of the blading shall be right at all loads, hence the empirical rule given above may be taken as a fair compromise, and, as stated, has been largely worked to in practice, and its convenience is obvious. The height of the first row of blades being fixed, the heights of all the others are obtained in the most simple and rapid manner possible. The method of fixing the height of the first row is also very simple. If n is the number determined from the equation $s^2 n$ = constant, the velocity of flow through the first stage is given by the relation $v = \frac{C}{\sqrt{n}}$, where C is often 2700 for a total expansion ratio of 64, and 3000 for higher expansions. The area available for flow is that of the annulus between the rotor and casing multiplied by the sine of the discharge-angle of the blades. As this angle is commonly made about 20 deg., and sin 20 = 0.34, one-third of the annulus may be taken as the area available for discharge. Thus in the case of the large turbine, of which data are given above, at full load the actual steam velocity through the first row of blades, allowing for dummy losses, which were 8 per cent, was 226 ft. per second. By the above rule it would be $\frac{2700}{\sqrt{144}} = 225$ ft. per second.

In passing, we may note that the actual ratio of this steam speed to blade speed was 0.44, and the gross over-all thermodynamic efficiency, taking the steam in its condition in front of the first row of blades, 61 per cent. The actual blade efficiency was, of course, much higher. Dummy and gland leakage, if eliminated, would certainly have brought the figure up to 65 per cent., and the mechanical efficiency was reduced by the fact that each turbine drove a reverse turbine, the fan action of which was sensible, although each reverse turbine runs, of course, in a vacuum.

Returning to the question of blade heights, it will be seen that in the case of the cross-Channel steamer, of which particulars are given above, the blade height at the entrance to the low-pressure turbine is 1 3/8 in. Four inches is the height of the last row of the high-pressure turbine, and hence the blade height on the low-pressure turbines should correspond to a height of $4\sqrt{2}$ in. on the high-pressure rotor. The diameter of the low-pressure rotor is 1.4 times that of the high-pressure. Hence, with the same blade height, the area provided would be 1.4 times as much as in the case of the high-pressure. The steam, moreover, moves 1.4 times as fast through the low-pressure blades as it does through the high-pressure blades, so that the net result is the blade height on the low-pressure rotor should be $\frac{44\sqrt{2}}{1.4 \times 1.4} = 2\sqrt{2}$ in. Since, however, there are two low-pressure rotors, the actual height will be one-half this figure, or 1.4 in.; say, 1 3/8 in., which, it will be observed, is the figure actually adopted.

In constructing electric-light turbines quite similar rules are used, and often with the same constant—viz., 1,500,000. The value of the co-efficient, however, depends much on the speed at which the turbine is run. It is common practice to use the same turbine if the speed is to be 1200 R. P. M. as when it is 500. In the one case the co-efficient will be 1,600,000, say; and in the other, 2,600,000. The latter figure has been worked to by more than one firm with turbines making 1500 R. P. M., the mean blade speed at high-pressure end being 128 ft. per second.

The rotor is commonly made with three different diameters, the mean speed for each diameter being 1.4 times that of the diameter immediately preceding. Thus, take the case of a turbine to develop 2400 kilowatts, at its over-load, with steam at 175 lb. per square inch gage pressure, and 150 deg. super-heat. The consumption at the over-load may be taken as not more than 17 lb. per kilowatt. For a mean blade speed of 128 ft. per second, the mean diameter required at 1500 revolutions will be about 19.5 in. The mean diameter of the intermediate pressure blading will then be $19.5 \times \sqrt{2} = 27\frac{1}{2}$ in., and of the low-pressure blading 39 in.

Taking the constant as 2,600,000, the number of rows of blades required on the rotor will be given by

$$n \times 128^2 = 2{,}600{,}000;$$

whence

$$n = 158.7; \text{ say, } 160.$$

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It is usual to design the high-pressure end so as to do one-quarter of the total work. Hence the number of rows of blades on this end will be $\frac{160}{4} = 40$. The intermediate blade speed being $\sqrt{2}$ times that of the high-pressure, the value of n for this portion will be 80; whilst for the low-pressure end we have $n = 40$.

The intermediate portion is also proportioned to do one-quarter of the total work, hence the number of rows of blades on it will be $\frac{80}{4} = 20$. The low-pressure end, on the other hand, accounts for one-half the total work, whence the number of rows on it will be $\frac{40}{2} = 20$.

Some makers subdivide the low pressure end of the turbine into two parts, increasing the mean diameter once again in the ratio $\sqrt{2}$ to 1. In this case each section of the turbine is rated to do one-quarter of the whole work. It is more common, however, to have three diameters only to the rotor, in which case the low-pressure end is, as stated, usually designed to do half the total amount of work.

Practice varies somewhat as to the speed with which the steam is allowed to flow through the first stage of an electric-light turbine. Some makers fix it much higher than others, with the result that the work at full output is more evenly divided up between the high, low, and intermediate sections of the turbine. With 64 as the assumed number of expansions, it may, as in in the case of marine turbines, be made equal to $\frac{2700}{\sqrt{n}}$ ft. per second; whilst if 81 is the assumed expansion ratio, it may be made equal to $\frac{3000}{\sqrt{n}}$. n is, of course, obtained from the relation already given — viz., $s^2 n =$ constant. Some designers work out the speeds through the whole turbine in great detail, apportioning to each group of stages, or "expansion," as it is commonly termed in the shops, its due fraction of the total heat theoretically available for conversion into work. The areas available for flow are then adjusted, not by the empirical rule given, but by direct calculation from the actual volume of the steam at each successive point of the turbine. Some very excellent results have been obtained in this fashion, but we are concerned here only with certain empirical rules which yield fair results in practice, and are very easy to apply.

We shall, therefore, take the nominal ratio of expansion as 81, and $v = \frac{3000}{\sqrt{n}}$ as the speed of the steam through the first row of blades.

Assuming a consumption of 17 lb. of steam is required per kilowatt hour, the total passed will be 40,800 lb. per hour, or 11.3 lb. per second. If the steam pressure above the governor-valve is 175 lb. gage, it may be taken at maximum output as 175 lb. per sq. in. absolute below this valve. Steam at this pressure and 150 deg. superheat will have a volume of about 3.25 cu. ft. per lb.; the volume passed per second will thus be some 37 cu. ft. Taking the steam velocity as $\frac{3000}{\sqrt{160}} = 237$ ft. per second, the net area required will be $\frac{37}{237} = 0.1560$ sq. ft. = 22.47 sq. in.

If the area of the annulus is three times the net area, or 67.41 sq. in., the blade height required will be $\frac{67.41}{19.5\,n} = 1.1$; say, 1⅛ in. In the above the fact that some 7 per cent. of the total steam supplied to the turbine commonly flows through the high-pressure dummy has been neglected. At the entrance to the intermediate expansion the steam will occupy (according to the empirical rule already given) three times its original volume. The mean diameter here being $\sqrt{2}$ times that for the high-pressure end, and the steam speed also $\sqrt{2}$ times as great, the height of blade for the first stage of the intermediate section will be $\frac{3}{\sqrt{2} \times \sqrt{2}} = 1.5$ times that of the first row of the high-pressure section. Similarly, the blade height for the first row of the low-pressure end will be 1.5 times that of the first row of the intermediate section. Each of these sections is commonly sub-divided into from two to four "expansions," or groups. The practice of makers here varies considerably. Some have only two "expansions" per diameter, while others have four, and the number 3 is also frequently used. Adopting the number 4, the blade height of the high-pressure and intermediate groups may be 1.31 times the previous blade height. We then get the following table of blading, the heights having been adjusted to even sixteenths, though the more common practice is to work to eighths:—

Group No.	I.	II.	III.	IV.
Blade height—high pressure end	1¼	1½	2⅛	2⅝
Blade height, intermediate	1⅛	2⅛	2¾	3½

To correspond with the high-pressure and intermediate sections of the turbine, the low-pressure end should have eight groups, with the following blade heights:

Group No.	1.	2.	3.	4.	5.	6.	7.	8.
Blade height (inches)	2.53	3.31	4.38	5.73	7.60	9.95	13.25	17.25

Here, however, two difficulties make their appearance. The most serious of these is the excessive length of the blades at the condenser end of the turbine. In practice, the blade height is not made more than one-sixth of the mean diameter, corresponding in this case to 6½ in. Hence the area required at the low-pressure end of the turbine must be obtained by the use of "wing" blades. These are blades of small curvature, the tangent to the curve of the back of the blade at entrance being at an angle of about 90 deg., whilst at discharge it is 45 deg. This gives a passageway to the steam equal to 0.71 of the annular area in place of the standard 1/3. Hence, using these blades, the height of the final rows may be 6½ in., corresponding to a blade height of 13.8 in., for the standard blades, which, it will be seen, is less than it should be; but this constriction of the steamway cannot well be avoided here without making the rotor in four diameters. On the Mauretania, however, wing blades giving a passageway of 0.86 per cent of the annulus have been used, but so large a degree of "winging" as this is not adopted in turbo-generator practice.

The other difficulty referred to lies in the fact that the total number of rows in the low-pressure rotor is only 20, which, if divided into eight groups, could give only 2½ rows in each, which is, of course, impossible. Hence the Groups I. and II. may be combined into one of the same height—say, 1¾ in.—consisting of five rows of blades on both rotor and casing. The increase of area necessary to give the expansion due to Group II. is obtained by "gaging" the last two rows of blades in both the rotor and on the casing. This is done by forcing a piece of metal between the blades so as to twist them more parallel to the axis of the turbines. By thus changing the angle of discharge from about 20 deg. to about 25½ deg., the desired increase in the passage for the steam is provided. Groups III. and IV. may be similarly combined, the height adopted being, say, 4⅜ in., the final rows being "gaged" in precisely the same way. The four groups remaining may then be made into one of ten blades 6½ in. long, the increase of area required from row to row being obtained partly by "gaging" and partly by the use of wing blades.

The steam consumption and the pressure below the stop-valve at smaller outputs are readily obtained by another empirical formula, or, rather, diagram. At

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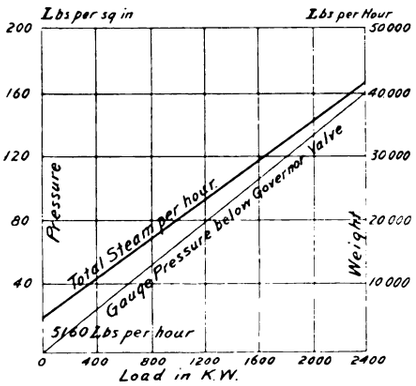
no load the turbo-generator commonly takes about one-eighth the total quantity of steam that it requires at maximum output, and the pressure below the stop valve is then not far removed from that of the atmosphere. At 2400 kilowatts the turbine proposed above will, it is assumed, take 40,800 lb. of steam per hour, and the pressure below the stop-valve is 175 lb. absolute, or, say, 160 lb. gage pressure. Plotting down a diagram such as that annexed, the consumption at 2400 kilowatts being 40,800 lb. per hour, it will be about 5100 lb. per hour at no load (magnets excited). Joining these two points by a straight line, the consumption is obtained at intermediate loads. Similarly, the gage pressure below the governor-valve being 160 lb. per sq. in. at 2400 kilowatts, it may be taken as atmospheric at no load (magnets excited). Joining these by a straight line as indicated, the gage pressure at all other loads can be read off with considerable accuracy, the output, in fact, being usually very nearly in direct proportion to the gage pressure



If the same turbine were run at 1200 in place of 1500 R. P. M., its output and efficiency would diminish nearly in direct proportion to the reduction in speed. In place of 2400 kilowatts it would generate about $\frac{2400 \times 1200}{1500} = 1920$ kilowatts, and the total steam consumption would be little changed. In fact, steam reaction turbines are generally run at ratios of blade speed to steam speed at which the efficiency curve is fairly well represented by a straight line passing through the origin.

At some future date we may compare the proportions obtained by these empirical rules with those demanded by a more complete theory of the action of the turbine, and with the results actually obtained in practice with a large turbine of which complete trial data are available. In the meantime the rules in question, in spite of their empirical character, may be taken as giving a very fairly proportioned turbine.

FASTEST WAR VESSEL IN THE WORLD.

There is at present undergoing her speed trials a torpedo-boat destroyer built for the British navy which can rightly claim to be, and will be for some time to come, the fastest war vessel in the world. She has been accurately named the Swift and has been built not only as a kind of experimental vessel, but under great secrecy at the Birkenhead ship building yard of Messrs. Cammell Laird & Co., on the river Mersey, Liverpool. Her displacement is about 1,800 tons and the horsepower of her turbine propelling machinery is nearly 30,000. That these are startling figures for a torpedo-boat destroyer will be evident to anybody who knows anything about this kind of war vessel, or cares to look up records of them. She belongs to no class nor are there any other ships building exactly on her designs. She is, as before stated, an experimental vessel for the British navy and her contract speed was stipulated at 36 knots. As a torpedo-boat destroyer she is the largest yet built, her principal dimensions being, length, between perpendiculars, 345 ft.; breadth, 34 ft.; depth, 20 ft. 4 in.; with a displacement at mean load draught of about 1,800 tons. Her armament consists of four 4-in. breach-loading guns, two on the forecastle and two on the upper deck, and two 18-in. torpedo tubes on the upper deck. She is fitted with quadruple turbine machinery of the Parsons type, which drive four shafts, there being one propeller on each shaft. The turbines are placed in two distinct engine rooms in order to minimize the capacity of any one watertight compartment, and several novelties have been introduced in order to accommodate machinery of the large power required in the comparatively small space at disposal. There is an installation of 12 boilers of the express straight tube type, these being arranged for the burning of oil fuel exclusively. Her designed speed is 36 knots, but whether the vessel will maintain this under severe admiralty conditions remains to be seen. It is a happy augury, however, that on some of her trials so far she has credited herself with 38 knots.

AWARDS FOR DESTROYERS.

Secretary of the Navy Metcalf on Sept. 19 awarded contracts for the construction of the 10 torpedo boat destroyers authorized at the last session of congress, and for which bids were opened recently. Each of the following companies is to build two of the destroyers: Fore River Ship Building Co., Quincy, Mass.; New York Ship Building Co., Camden, N. J.; Newport News Ship Building & Dry Dock Co., Newport News, Va.; Bath Iron Works, Bath, Me., and William Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.

The contracts with the Fore River and Cramp plants are for the construction of vessels on their own plans for hull and machinery, the remainder of the vessels to be constructed on the plans made by the navy department.

TRIALS OF SCOUT CRUISERS.

The three scout cruisers, Chester, Salem and Birmingham, the only ships of their class in the world, are to leave the Charlestown navy yard within a few days for the exhaustive set of competitive tests which will be watched everywhere with interest.

The final official acceptance trials will be: Oct. 6, the Birmingham; Oct. 8, the Salem, and Oct. 11, the Chester. Then will come the standardization tests over the official measured mile course, off Rockland, Me., the Birmingham, Oct. 16; the Chester, Oct. 18, and the Salem, Oct. 25; after which the three cruisers are ordered to assemble on Nov. 15 at Hampton Roads, whence they will start on a 2,000 to 3,000-mile, coal-endurance test and competitive run to Guantanamo. This last test will be for the purpose of establishing the merits of the different kinds of motive power used respectively in the three cruisers, under equal conditions, both as to the amount of coal consumed, sailing and uniform manœuvers.

It is reported that the Oceanic Steamship Co., of San Francisco, has arranged to sell to the Pacific Mail Steamship Co., the steamers Ventura, Sierra and Sonoma. These steamers are controlled by the Spreckels interests and were taken off the San Francisco - Honolulu - Australia run several months ago and have since lain idle. The Pacific Mail Steamship Co. is controlled by the Harriman lines and it is said to be the intention to institute an express service to Ancon, on the Pacific side of the Isthmus of Panama, thus enabling coast bidders to compete in the matter of supplies for the Panama canal. John D. Spreckels has announced that there is nothing in the report, but was unwilling to discuss the matter definitely.

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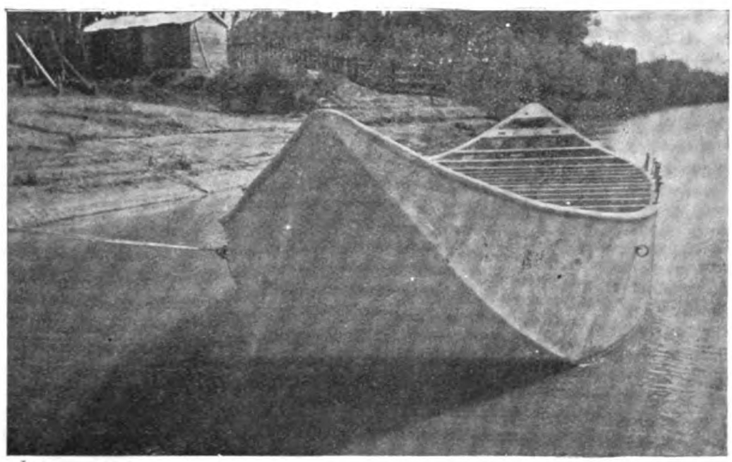
Reinforced Concrete as a Building Material for Boats.

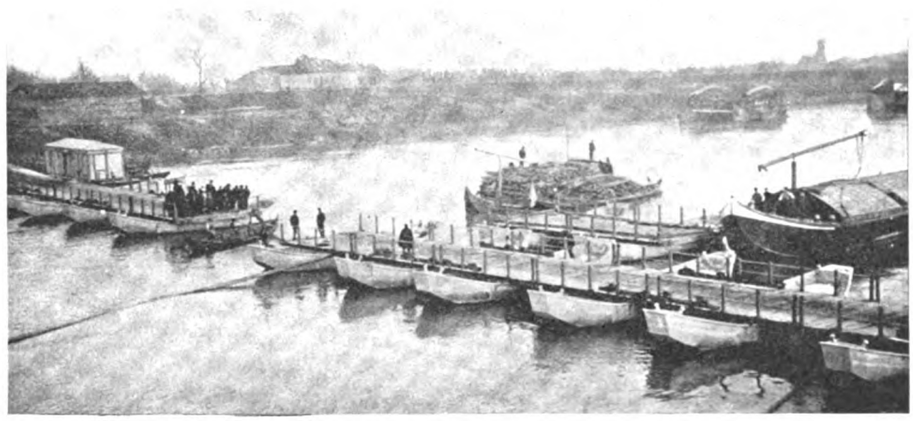
(From the *Scientific American.*)

The utilization of reinforced concrete as a constructional material for various purposes for which masonry, wood, or ironwork has been previously employed, has undergone considerable development during the past few years. One of the most novel applications of the system, however, is that which has been evolved and perfected by a well-known Italian engineer, Signor Carlo Gabellini, of Rome; namely, its adoption for the construction of boats and floating structures in general, such as pontoons, floating bridges, and so forth.



A REINFORCED CONCRETE PONTOON FOR THE BRIDGE AT PAVIA.

Signor Gabellini first drew attention to the possibility of extending such a system to maritime purposes, as far back as the nineties; and in order to demonstrate the feasibility of the idea, built a small rowing boat capable of carrying some four or five people. The whole of the craft from keel to gunwale, including seats and rudder, was carried in armored cement, and upon launching was kept in the water at Port d'Anjio for four years, to illustrate on a practical scale that the immersed cement surface is not damaged by sea water and offers no suitable adherence surface to seaweed and other marine growths. Today the boat is still in service, the hull never having once been cleaned, and is in as good condition as when first placed in the water. That salt water exercises no deleterious effect upon the cement sheathing is perfectly obvious; and although the boat has been in constant use for some eleven years, the surface is without the slightest pitting or traces of decomposition. During the whole of this period the hull has required no repairs whatever, which fact points to the durability and serviceability of reinforced concrete for such purposes.



A FLOATING BRIDGE ON THE PO SUPPORTED ON REINFORCED CONCRETE PONTOONS.

The signal success of this initial practical experiment was followed in the same year by the construction of a floating chalet or boathouse for the Aniene rowing club, which is still moored to the bank of the Tiber. Similarly, in this instance the whole of the building, including both the pontoons and the superstructure, was carried out in reinforced concrete.

There are eight pontoons disposed in two outer rows extending to a total length of 67 feet by 21 feet beam. Each pontoon measures approximately 16 ft. in length by 9 ft. beam. They are of rectangular section, of the flat-bottom type, there being a slight batter of about 15 degrees from the bottom to water level, whence the sides rise vertically to the top of the structure. The shell is of the single-wall type, strengthened transversely by cross beams, also executed in the same material. The iron skelton comprises iron rods of round section with iron network or expanded metal between, around which the concrete is built. The pontoons after construction were towed to their destination and bolted firmly together in two rows, the intervening space of some 3 feet between each row being occupied by transverse reinforced-concrete girder members extending from the water level to the upper edges of the pontoons, placed at intervals so as to come in line with the transvening space of some 3 ft. between each giving continuous strength at those points from side to side of the structure. The whole was bolted up to form a rigid homogeneous floating mass, the ends of the pontoons on the upstream face being wedged shaped to form cutwaters, the other extremities being left square in section. Upon this raft the boathouse

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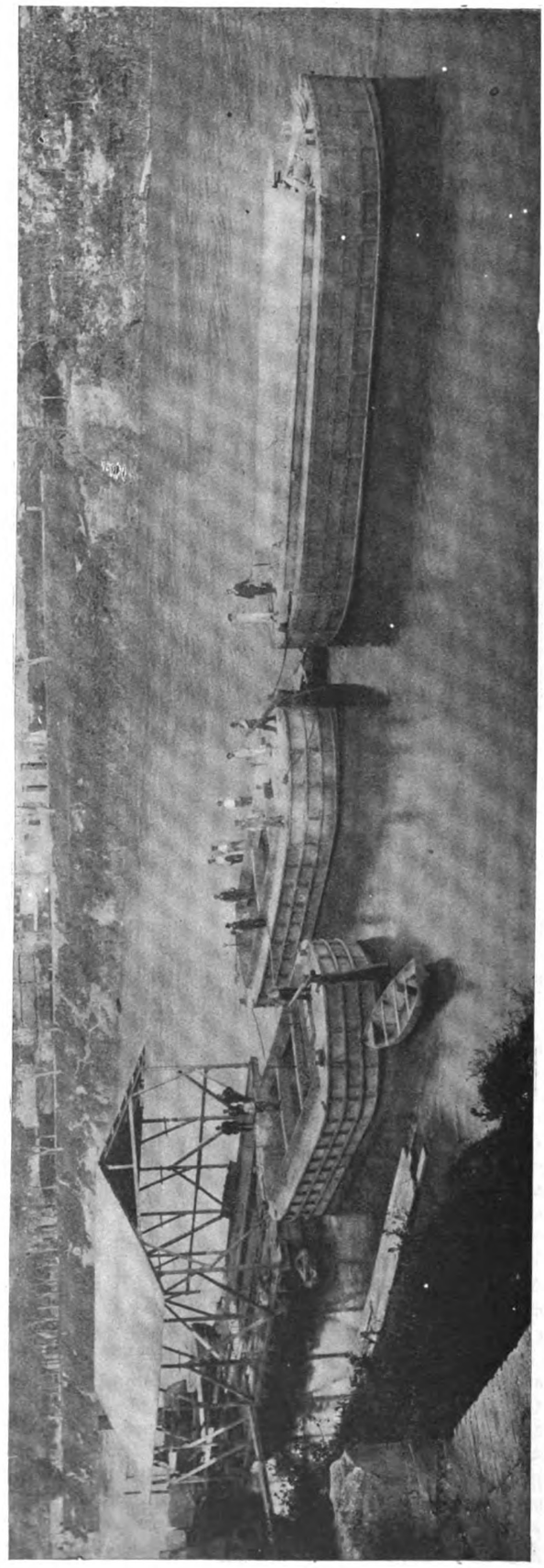
was built, consisting of a single floor at either end with a double-decked house in the center, the roof line of which runs at right angles to the main building, which extends longitudinally. The vertical uprights of the iron reinforcement of the building rise from the floor level, and the intervening spaces between are filled with expanded metal, the roof being built upon the same lines. As may be seen from the accompanying illustration, the external characteristic appearance of a chalet is preserved, the pseudo-wooden joists being relieved with rough-cast.

In the past two or three years, the efficiency of the system having thus been demonstrated over a period of nearly a decade, the principle was applied to larger vessels, such as freight barges, one of the first of these being the "Liguria," the construction of which was commenced in 1905. This craft is 54 ft. in length with a beam of 18 ft. Construction was carried out upon the same lines, and the disposition of the iron reinforcement and expanded metal may be seen in the accompanying illustration, where the hatchway is being completed. In order to reduce resistance to the water to the minimum, the outer surface is cleaned, rubbed down, and smoothed until it has the appearance of polished marble and experience has shown that once this effect is achieved, the surface is preserved indefinitely, so that the craft always offers a minimum of skin friction in the water.

The illustration also shows the manner in which the vessel was constructed. Instead of being built upon an inclined slip on the river bank and then launched when completed in the usual manner, the stocks were provided on a floating pontoon dock, built in reinforced concrete. When ready for transference to the water, the pontoons at one end were submerged, in this manner providing the necessary inclination to insure the boat's traveling down the slipway into the river.

Upon completion the "Liguria" was towed down the Tiber from the building stage to Genoa, and is now in daily service in the harbor, transporting coal. During the two and a half years it has been in commission, the barge has given complete satisfaction. There have been no maintenance charges whatever, and the slight resistance offered to the water, owing to the smoothness of the outer surface of the hull and its immunity from clogging by marine growths, has been a noticeable feature, in comparison with the difficulties encountered in this direction by other wooden, iron, and steel vessels plying in these waters. In consequence concrete craft maintain a constant high degree of efficiency.

The results that have already been



THREE 100-TON REINFORCED CONCRETE CARGO BOATS, BUILT FOR THE ITALIAN GOVERNMENT, READY TO BE TOWED TO THE MILITARY HARBOR OF SPEZIA.

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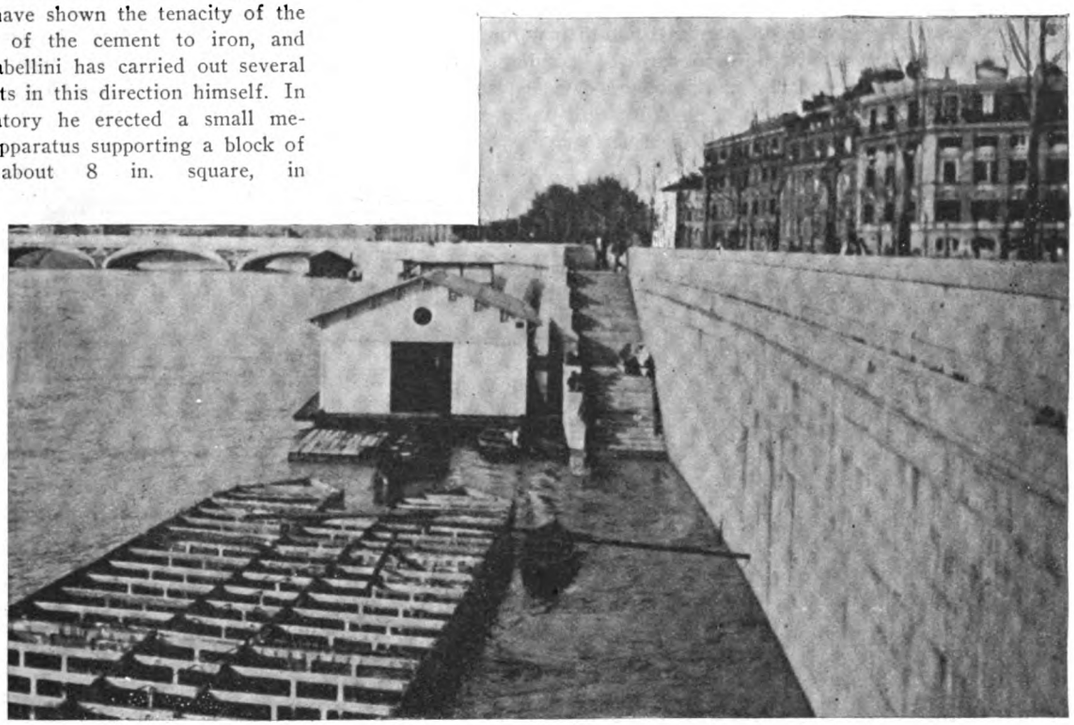
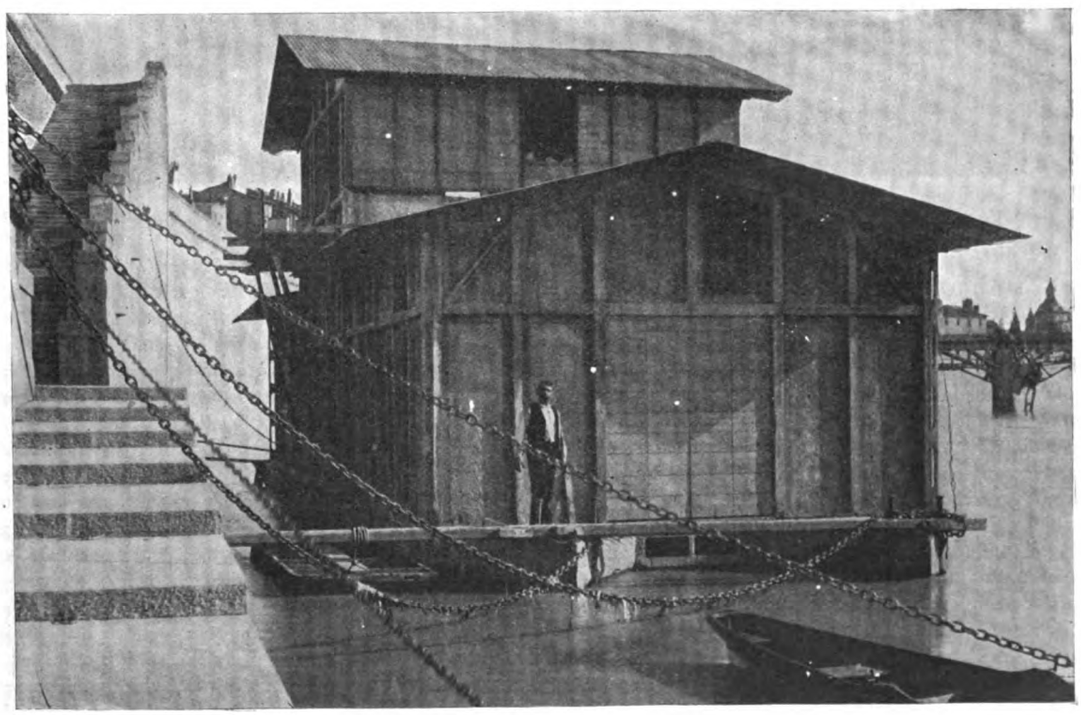
achieved have proved the complete adaptability of armored cement to marine construction. Although a boat so built is somewhat heavier than if wood were employed, it has the compensating advantage of being far more economical to maintain. Construction itself can be carried out as rapidly if not more expeditiously as in either wood or metal. Researches have shown the tenacity of the adherence of the cement to iron, and Signor Gabellini has carried out several experiments in this direction himself. In his laboratory he erected a small mechanical apparatus supporting a block of cement about 8 in. square, in which was inbedded a section of round iron rod such as he uses in his system. A weight of 1,320 pounds was suspended from the iron rod, the object being to force it away from the cement, but although the strain was applied continuously for three months, no evidence of separation was observable, and the block was found as perfect and as intact as the day upon which it was made.

The question naturally arises as to the capability of such a structure to withstand such shocks as pounding against piers and other craft. Tests in this direction have conclusively proved that although the fabric has great rigidity, yet



THE PONTOONS WHICH SUPPORT THE FLOATING BOATHOUSE.



FLOATING CHALET OF REINFORCED CONCRETE FOR THE ANIENE ROWING CLUB ON THE TIBER.

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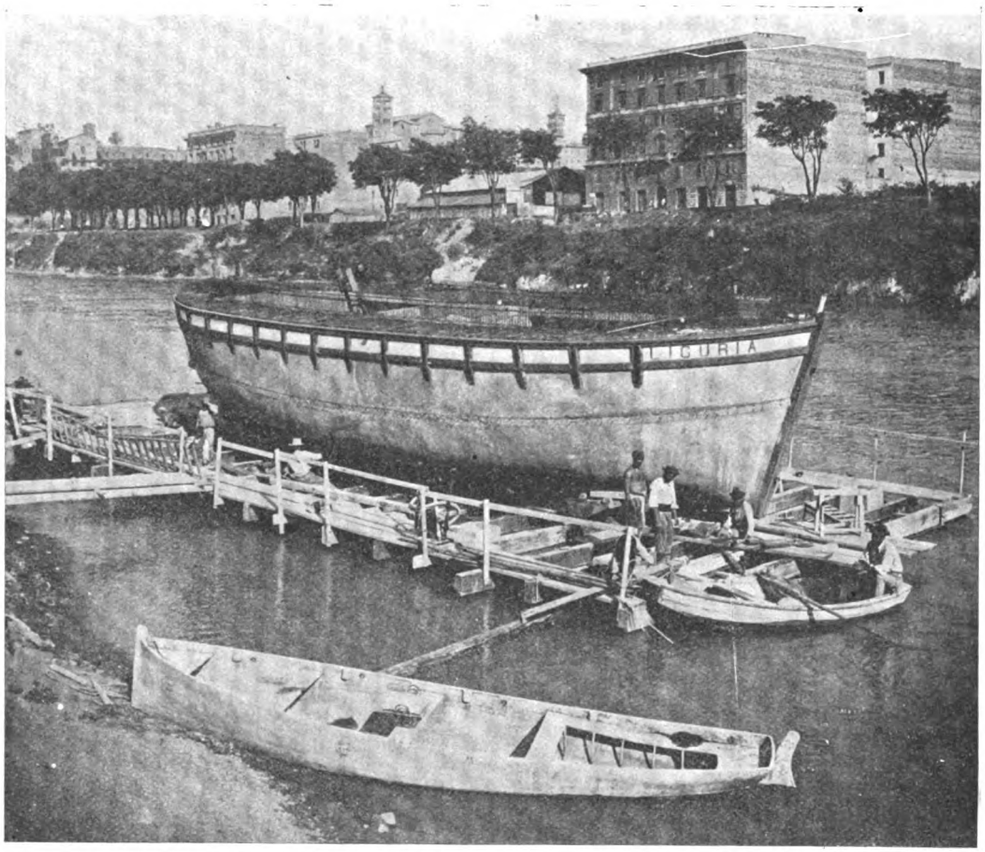
it possesses a certain degree of elasticity, and even should the blow be sufficiently violent as to damage the fabric, the injury is purely local in character.

The system of construction is very simple. The keel is laid in the usual manner, the iron rod reinforcement being anchored to the armoring of the former, and being brought up the sides of the hull in conformity with the desired lines of the craft. The iron rod generally used has a diameter of about 0.4 in. The expanded metal, which has a mesh of about 0.2 inch, is stretched between the vertical supports, to which it is attached by suitable metal clips. The concrete is then applied to the skeleton fabric in layers inside and out equally, the thickness of this sheathing varying according to the dimensions of the craft. It will thus be realized that building can be carried out very cheaply, while it also does not call for such highly skilled labor as ordinary ship building. The cement work completed, the outer surface is subjected to a thorough cleaning to give the requisite polished, marble-like appearance.

The system has been utilized for the peculiarly shaped boats which serve to support the decks of the quaint floating bridges to be found on the River Po. Hitherto wooden boats have been strung across the waterway, the deck planking, built in sections, being laid transversely across them. When a vessel desires to pass in either direction, the necessary opening is made by withdrawing a certain number of boats together with the bridge decking clear out of the way, thus leaving an uninterrupted channel, the bridge being reformed merely by rowing the boats into their normal position. The boats are of peculiar design, having sharp-pointed rising ends. In such reinforced concrete the same general lines are preserved, only the ends are made blunter, a greater midship beam is provided, while they have perfectly flat bottoms, forming a kind of pontoon. Each boat is 45 ft. in length, with a beam of 12 ft. and a depth of 3.6 ft. So satisfactory have the craft proved in service, the absence of repairs being a pre-eminently distinguishing feature, that the wooden boats for these quaint floating bridges are being superseded by the reinforced concrete craft as rapidly as possible, over one hundred having already been built for this service.

A few months ago the Italian government, whose engineers had reported favorably upon this system of construction, contracted with the Gabellini Company for the construction of a special type of 100-ton cargo boat which should be suitable to their requirements, for the purpose of submitting the principle to a series of exacting tests to determine practicability, efficiency, stability, and seaworthiness. The boat was built at the floating shipyard of the company on the Tiber at Rome. The boat has an overall length of 51 ft., with a beam of 16 ft. and a depth of 7.5 ft., the draft without cargo being 3 ft. The type adopted is pointed fore and aft with a single clear hold. In outward appearance it differs slightly from the "Liguria." The hull has a double shell, the intervening space being subdivided into a number of watertight compartments, each complete in itself, while the outer shell above the waterline, where it is subject to the greatest possible damage from collision with other objects, such as quays, piers, and other vessels, is especially strengthened, so that in the event of one or more compartments being pierced, the craft will still remain afloat.

Upon completion this freighter was towed to the military harbor at Spezia, where it was subjected to a severe series of tests by the military department. These proving completely satisfactory, the government ordered four similar



THE BARGE "LIGURIA" IN COURSE OF CONSTRUCTION ON A FLOATING PONTOON. THE BOAT IN THE FOREGROUND IS ONE OF THE FIRST BOATS BUILT OF REIN FORCED CONCRETE.

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barges of the same dimensions and tonnage, which are now being completed. These craft are additionally strengthened transversely by concrete beams, which extend straight across the holds. The external shell is divided into panels, and when a rent is made in the fabric, it is necessary only to lay bare the iron reinforcement at the point of injury, repair the damaged sections of metal armoring and network, and apply the coating of cement. In this manner the most extensive injuries can be easily repaired in the course of a few hours. The system moreover is more hygienic than either wood or iron, and can easily be maintained in a perfectly clean condition, the holds being flushed out with a hose.

Signor Gabellini is advocating the manufacture of armor plates upon this principle. The system is fundamentally the same as adopted in torpedo boats, but is considerably strengthened. The plate is built up to the requisite thickness of superimposed layers of the armoring, with intervening layers of cement, and so made as to form a perfectly homogeneous plate. In this arrangement the iron rods are disposed at right angles to one another in each layer, to secure the maximum effect of resistance and strength. The number of layers of reinforcement can be varied as desired. From the experiments the inventor has made he has determined that it is possible to secure the same degree of resistance to projectiles as a given steel plate with from 33 to 50 per cent less material. The advantage of such a plate, he points out, in addition to its high degree of resistance to penetration, is the facility with which it can be repaired.

Concrete boats are not altogether a novelty in the United States. An engineering firm in Missouri has been engaged for some time in building small concrete power-propelled boats for river use.

GAS-DRIVEN BATTLESHIPS.

Discussing the recent experiments with gas engines as the means of propelling battleships, conducted by the British naval department, fitting out the old ship Rattler with 50-H. P. engines, and a later report, that the admiralty had ordered a 19,500-ton battleship of this type, Dr. Charles E. Lucke, professor of mechanical engineering in Columbia University, said that the upholders of the gas engine were too forward in their claims.

"It is my opinion that Nixon is too optimistic," said Dr. Lucke. "There is no doubt that the combination of gas producer and engine will drive vessels more economically than steam, and that labor conditions in the ships will be improved by the adoption of this kind of power. But we have not the producer or the engine as yet. You cannot go in the market today and buy a gas engine that will drive a large ship. There are plenty of designers that will promise to build one, but engineering experience has proven that it is a long trip from designer to successful installation.

"The adaptability of stationary gas engines to the propulsion of battleships and liners is entirely possible, but it will not come in many years; it will not be tomorrow nor the next day. The experimental stage may begin actively at once—the reduction to engineering practice is a development of some time. I should put it at from 5 to 10 years; approximately in 10 years we will have a ship that might be considered as standard.

"The British navy spends much more on experiments than that of the United States, and the reports of the adoption of the gas engine do not mean anything final, but rather that it considers it a profitable field of investigation. I could not advise the United States naval authorities to even begin experiments; it is too soon to begin now. The engine and producer should be bettered by private study and trials on the part of those that are interested.

"There is one serious drawback to the installation of the gas engine and producer as it is at present in ocean traffic, and especially in the tramp freighters, with their irregular ports of call, and that is the problem of coal supply. The gas producer, as we know it now, is by no means so flexible in its use of coal as the steam boiler, although Mr. Nixon claims that he can burn a variety of fuels.

"It has often been said that the gas producer can handle any kind of coal, and so it can, but not commercially. The automobile is eminently successful as a vehicle, but in does not compete with the railroads as a carrier of freight traffic. A thing of this kind that cannot be done commercially is not successfully applied. Any gas producer might burn any kind of coal, but there would be so much trouble that it would be impracticable from a business standpoint. I think that Mr. Nixon is too optimistic in claiming the latitude of fuels which he mentions.

"The engine does not offer so many difficulties as the producer, though there is no engine now built that could be thought nearly ready for application to the problem of battleship propulsion. There is no vertical engine large enough; some designers believe that they could build one right away, but the fact remains that none has been made. It means time, money, and thought expended in years of experiment. I say again that the ships driven by gas engines will come, but I wish to correct the notion that they have arrived.

"In the matter of the saving of coal, the proportionate consumption, compared to steam, varies as the size of the gas engine. The largest gas engine at present is one of 5,500 horsepower in the power house of the San Francisco Gas & Electric Co., and we may base our figures on that. The saving in the larger sizes, say of over 10,000 H. P., would be 20 per cent, to put it at more would be too optimistic; in smaller installations, of units under 1,000 horsepower, it might be from 75 per cent to 90 per cent. As you see this consideration grows less and less in importance in the larger engines, and those required for a battleship would be of the largest.

"The only investigations that have been conducted have been by the United States Geological Survey, in their experiments towards the conserving of the fuels of the country. They made investigations in the possible use of low grade coals—the brown coals and lignites—with a view to finding out the difference in the consumption of the two types of engine. The comparison showed the gas engine to be the most economical, but the fact remains that these figures are often misinterpreted, and false conclusions are drawn, for it is certain that the larger plants will not make so good a showing.

"Again, the first costs of the gas installation will always be greater than the steam, and this makes competition far less favorable until the gas engine has reached at least a more stable foundation.

"It is in the problem of labor that the gas engines as applied to ships will bring about the greatest saving and better conditions. The terrible heat and overwork of the stoking will be eliminated, and the whole ship will be more comfortable.

"I look for the first application of the gas engine to canal and river traffic, where the power required is less and the demand on the flexibility is not so great as in the trans-oceanic liners. When this has been successfully tried and proved, then we may turn to the battleships and ocean liners, but not before."

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ADVANTAGES OF A SYSTEMATIC AND REGULAR METHOD OF WORKING THE FIRES IN A BOILER.*

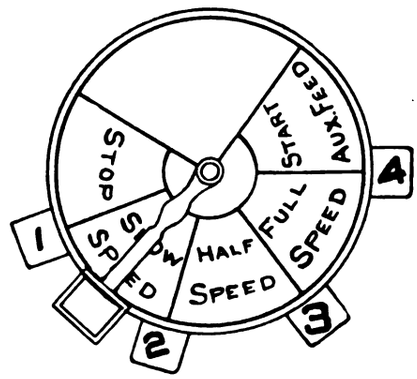
BY LIEUT. COM. R. K. CRANK, U. S. N.

It is thought that the advantages of some regular systematic method of working the fires aboard ship over the old unmethodical way of "every man for himself" are so apparent to any one, be he officer or enlisted man, who has had any experience with and without any systematic method, that it is unnecessary to dilate unduly upon these advantages. The average sailor man will growl over the introduction of any innovation, for the reason that it is new and because he likes to growl; but if one may judge from the experience on this ship (Louisiana), not a single fireman would vote to go back to the old way of working the fires.

The advantages of a regular systematic method of working fires, by periodic signals to the fire rooms, were deeply impressed on the writer on the trial trips of a number of the new and larger ships which he attended in the winter of 1905-1906, especially when the well-ordered methods in the fire rooms of the Louisiana on her trial were contrasted with the comparatively confused conditions in the fire rooms of the Missouri on the trial of that vessel by the same builders. These two examples alone were sufficiently convincing.

Assuming the advantages of a system to be indisputable, the writer submits these notes in the hope that they may contain some suggestion that may prove of use to officers on board those ships in which no automatic signals for working fires have been fitted or used and in which no regular system of firing has been employed.

In August, 1906, about one month after the Louisiana quitted the Norfolk navy yard on her first service after commissioning, the fire room telegraphs were fitted so as to permit them to be used as transmitters for sending firing signals. The accompanying sketch shows the manner in which each transmitter was fitted. As will be seen, the numbers by which the different furnaces or fires are designated were marked in large figures on pieces of sheet brass which were secured to the back of the dial and opposite the lines of demarcation between the divisions already in the face of the dial (that is, the division marked "Stop," "Slow Speed," "Half Speed," etc.). When it is desired to send a signal, such as "Stop," "Slow Speed," etc., the pointer of the telegraph is put in the middle of the proper division on the face of the dial (in the sketch, "Slow Speed" is indicated). When the telegraph is in use for transmitting signals for working the fires the pointer is placed opposite and in line with one of the figures by which a particular fire is designated. A man is stationed at the telegraph in the starboard engine room, with a timepiece, and instructed to send the signals in rotation at a stated interval between two successive signals. After trial it was found that for ordinary cruising speed

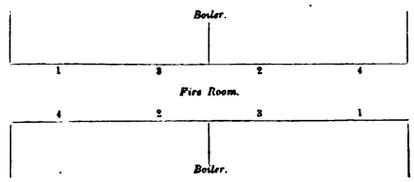


(12 or 13 knots), with about seven-twelfths boiler power, the interval between successive signals should be about two minutes. This interval, for any particular ship, can be determined only by trial.

Facing the boiler, the furnaces are numbered as shown below, viz.:

This numbering of the furnaces is slightly different from the numbering at the time of the trial for reasons that will be given later.

The cycle and sequence of operations followed in working the fires are as follows, viz.: Whenever a signal was received in the fire room, the fire indicated by that signal (No. 1, 2, 3, or 4) was raked, and immediately afterwards and without any further signal the fire next to the one just raked and on the same side of the boiler with the one just raked was coaled. Always, on receiving a signal, the first operation was to rake the fire indicated by the signal and then coal the one next to it. The sequence, therefore, would be:



Signal.	First Operation.	Second Operation.
No. 1	Rake Fire No. 1	Coal Fire No. 3.
No. 2	Rake Fire No 2	Coal Fire No. 4.
No. 3	Rake Fire No. 3	Coal Fire No. 1.
No. 4	Rake Fire No. 4	Coal Fire No. 2.

Taking any one fire (as No. 1), it will be seen that it is raked in one cycle and coaled in the next; also, referring to the diagram of the numbering of the furnaces, it will be seen that there is always a bright fire and a freshly-coaled fire in the same side of the boiler. With the numbering of the furnaces on the trial, there would be always two bright fires together in one-half of the boiler and two green fires in the other half of the boiler.

In order to counteract the persistent tendency of the firemen to fire too heavily and to pile the coal up in front of the furnace, particularly in the cases of those men who had been accustomed to firing Scotch boilers by firing "on the dead plate," where the fresh charge was allowed to coke before being shoved back, orders were given that not more than four shovelfuls of coal should be put on any one fire at one time. With a regular system of firing it was possible to go into any fire room at any time at sea, and by an inspection of any fire to determine whether or not the fireman had been carrying out orders and whether or not he was firing properly and efficiently. Although great improvement resulted from the use of the system and the limiting the amount to be put on any one fire,, it has not been possible, in the five months of steaming since commissioning, to get the older firemen into the habit of carrying level, light fires, despite entreaties, prayers, profanity, and dire threats. With a good system of firing signals it would be possible to make better firemen, for a particular type of boiler, from green men who had never fired at all but who were intelligent and willing to do as they were told, than from old men who consider themselves past masters in the art of firing. An efficient feed-water regulator would prove of the greatest assistance, for the average watertender is so constantly exercised and pre-occupied, with a water-tube boiler, in watching the water level in the gage glass and tending the throttle of the feed pump or manipulating the check valve, that he devotes little or no attention to the working of the fires. With a system atic method of firing and a feed regulator that would maintain a constant water level there would result a regularity of steam pressure and an evenness of distribution of

*Journal American Society of Naval Engineers.

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the work amongst the boilers in use that would conduce greatly to economy of steam production, to the maintenance of a regular speed, to the life of the boilers, and to the peace of mind and comfort of the entire engineering personnel. We hear of special courses of instruction for every special class of men in the service except those who have to do with the motive power. When the conditions of the service will permit, special instruction on special ships should be given in firing and the rudiments of engine driving and the care of machinery. If as much thought were given to firing boilers as to firing guns the results would be little short of amazing; but lacking these Utopian conditions, much may be accomplished by seagoing officers with the material on board. The adoption of any sort of a system of firing, by the increased regularity and economy in the production of steam and the gage it affords on the abilities of the men, will amply repay the slight effort needed to put it in operation.

The Dake Steam Turbine.

The accompanying illustrations show a new turbine, in which the steam is made to repeat its action upon the buckets of the same wheel, as in the Riedler-Stumpf type. This turbine is the invention of Chas. W. Dake, Grand Rapids, Mich., and is being manufactured by the Dake American Steam Turbine Co. of that city.

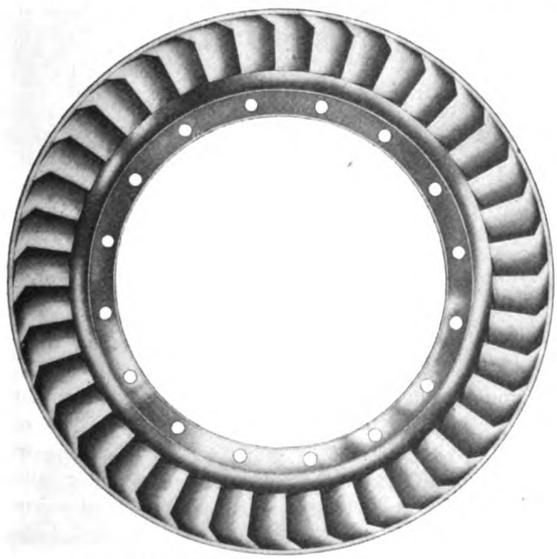

FIG. 1—RING OF MOVABLE BUCKET.

FIG. 2—DAKE ROTOR ASSEMBLED.

In Fig. 1 is shown a ring into the side of which the buckets are milled and which is bolted to a disk to form the rotor of the machine as shown in Fig. 2. Fig. 3 is a detail view of one of these buckets and shows a peculiarity of them, in that they are cut in steps which permits the better utilization of the space afforded by the thickness of the disk. This also preserves a nearly uniform distance between the discharge end of the nozzle and the wall of the buckets.

The complete rotor comprises a disk, upon which two of these bucket rings are bolted, as shown in Fig. 2. The guide nozzle is placed between the bucket rings as shown in the drawing, Fig. 6. Fig. 4 is a diagramatic view of the buckets and nozzles. The construction is such that the steam is guided directly upon the working surfaces, reducing the loss due to the formation of eddy currents. Experiments made by the inventor show a considerable increase of torque, which can be produced with a given nozzle and rate of flow by the use of this form of bucket. The nozzle block is shown in Fig. 5 and in section at A, Fig. 6, and also at A in Fig. 7, the latter being a section of a multiple stage turbine. The buckets are cut down on a bevel at their outer edges as plainly shown in Figs. 1 and 3, and the nozzles are extended upon a corresponding bevel as shown in Fig. 5. This confines the steam against the curved wall of the bucket. The nozzles are produced by inserting wedges C C, Fig. 4, into passages of rectilinear cross section, the wedges being varied to produce any form of nozzle desired, and adapted to any degree of expansion with a standard form of construction.

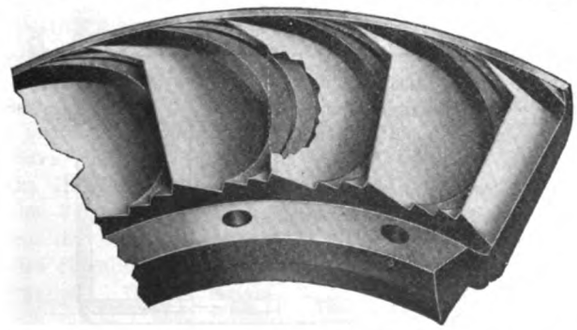

FIG. 3—DAKE BUCKET, SHOWING BOUNDING WALL AND BEVELED EDGE.

Referring to Figs. 6 and 7, the action of the steam can be clearly understood. It passes from a steam chamber, in the nozzle bucket through the nozzle, and is discharged upon the outer edge of the movable bucket D. This bucket deflects it, causing it to give up a portion of its velocity and energy to the moving disk, and then discharges it into the passage of the stationary guide-block A underneath the nozzle block. This guide-block causes it to impinge upon the moving bucket E upon the opposite side of the rotor, it escaping from the outside edge into the exhaust passage, whence it is carried to the atmosphere in the single wheel machine, or to the next stage as shown in Fig. 7, where more than one rotor is used. In turbines of this type even the single wheel machine is compound, as the steam acts twice upon different sets of buckets.

The governor is of the centrifugal fly-weight type and is direct connected to the turbine shaft. In the single wheel machines the governor operates a pilot valve, which opens and closes a port governing a piston valve. This valve in turn admits steam to the turbine or shuts it off, the admission always being at the maximum pressure. In the multiple stage turbine, governing is accomplished by a make-and-break connection of a shaft, driven by worm gearing, with a shaft con-

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nected to a rotary valve. One-quarter turn of this valve opens or closes the ports leading to the nozzles. The connection between the shaft sections is made by a clutch operated by a forked lever direct-connected to the generator. Lubricating oil under pressure is supplied to the journals by means of an oil pump driven by the machine itself. Each journal also has an oil ring by means of which lubrication is continued, if, for any reason, the supply of oil from the pump is interrupted.

The repeated action of the steam makes it possible to attain a high degree of efficiency at moderate rotative speeds, and the turbine can be built for direct connection to electric generators, fans, blowers, etc. It is built in sizes from 10 horsepower up, and may be made reversible with but little addition to the weight and complexity.

Fig. 8 shows a single stage 10-horsepower, and Fig. 9 a three-stage 100-horsepower machine. The company is now building a 375-horsepower turbine, which is to be reversible, and which will, this spring, be installed in a steam yacht for demonstration purposes.

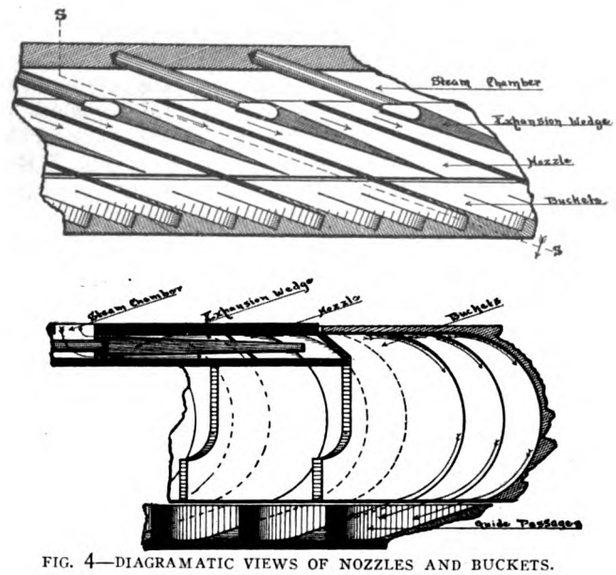

FIG. 4—DIAGRAMATIC VIEWS OF NOZZLES AND BUCKETS.

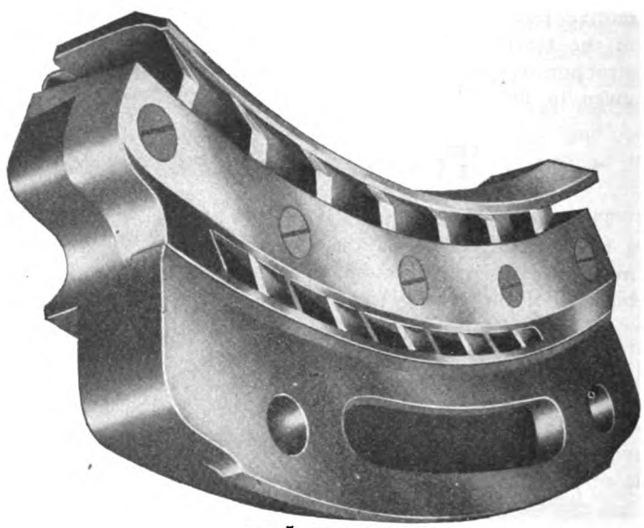

FIG. 5—NOZZLE BLOCK.

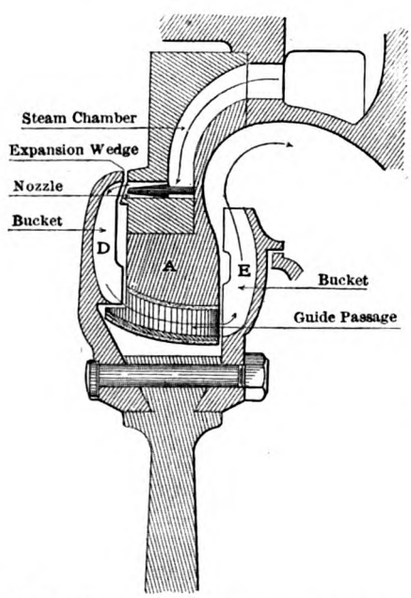

FIG. 6—SHOWS PASSAGE THROUGH RUNNING BUCKET AND GUIDE BLOCK.

ITEMS OF GENERAL INTEREST.

All previous records for discharging at the naval coal depot at Bradford, R. I., were broken on Aug. 21, when 2,027 tons were taken from the navy collier Nero, in 7 hours and 10 minutes. The record was made by the station force and eclipsed the former record of 1,800 tons in 7 hours, made July 20, on the Abarenda.

The first work of dock maintenance for the port of Philadelphia for the year 1908 was begun Sept. 16 by the dredge Pacific when it lifted the first bucket of mud from the north side of Pier 80, South Wharves, so that the big Italia liner Taormina will be able to berth safely on her arrival in port. Never before has Philadelphia allowed the first eight months of the year to pass without work of some importance in dredging. Within 14 hours of the time contract was closed for this piece of emergency work Assistant Director Hasskarl, of the department of wharves, docks and ferries, superintended the lifting of the first of the material. The importance of dredging out the badly filled in docks has been impressed upon the city's administration and it is promised that the necessary appropriation shall be forthcoming.

The steel passenger Chippewa, running from Seattle to Victoria for the International Steamship Co., was in collision with the passenger steamer Sentinel, owned by the Kitsap County Transportation Co., near Seattle, Sept. 12. The Sentinel, the smaller vessel,

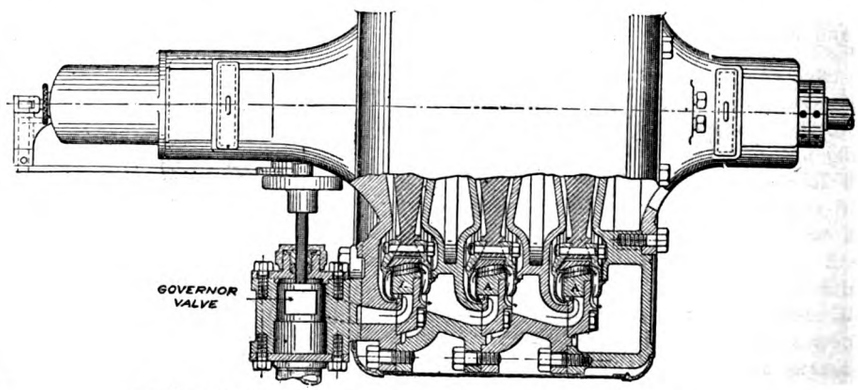

FIG. 7—THREE-STAGE DAKE TURBINE. SECTIONAL ELEVATION.

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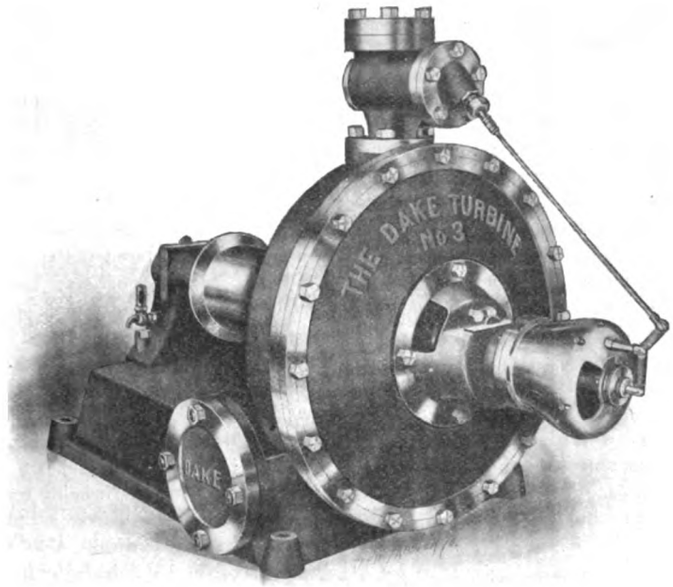

FIG. 8—DAKE SINGLE-STAGE TURBINE.

had her bow smashed, and it was necessary to lash the steamers together and transfer her passengers to the Chippewa. No lives were lost in the accident.

A collision occurred Sept. 13 between the Head line steamship Malin Head and the Allan liner Corinthian 30 miles below Quebec. The Malin Head was so badly damaged that she

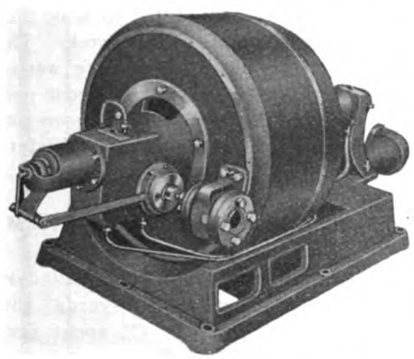

FIG. 9—THE DAKE 100-HORSEPOWER, 3-STAGE STEAM TURBINE.

had to be beached while the Corinthian put back to Quebec. A dense smoke from the forest fires covered the river at the time. No loss of life is reported.

Masters of some of the wind jammers which have been lying idle for several months in Puget Sound are reported to be disappointed over a clause of Lloyds that any vessel placed on the beach for cleaning may be considered as stranded. It was the intention of these masters to put their vessels on the beach for cleaning and thus save dry dock charges, but Lloyds representative was instructed to regard the vessels as stranded, with the consequent advantages to the underwriters, and none of them has tried the scheme, although it was common enough in the old days.

The Bermuda Atlantic Steamship Co., according to a consular report from the island, has been formed by an association of business men in Bermuda and the United States, and will probably establish a new passenger service between New York and St. George, Bermuda, consisting of a steamer with a capacity for 150 first-class passengers, and carrying neither second-class passengers nor freight, to make the distance in 45 hours from dock to dock.

The monitor Wyoming is to go into commission on Sept. 28 at the Mare Island navy yard. She has been out of commission ever since she was disabled by the breaking of a propeller shaft off the southern California coast three years ago. In the meantime she has been thoroughly overhauled and equipped with oil-burning apparatus for experimental purposes.

At the maneuvers which are being carried out by a submarine fleet in Buzzard's Bay, the Octopus, Viper, Cuttlefish, Tarantula and Plunger made a joint theoretical attack upon the cruiser Yankee, and technically speaking practically destroyed that vessel. The attacking force was in command of Lieut. Charles C. Courtney, of the Octopus, and the maneuvers were held in the waters of Buzzard's Bay last week.

NAVIGATION OF AMBROSE CHANNEL.

Appeals have been made to the president and to the war department by Atlantic steamship lines for permission to navigate the Ambrose channel in New York harbor at night, but as the channel is in an uncompleted state Chief of Engineers Marshall has advised the secretary of war that any premature opening of it to night traffic would introduce the possibility of accidents. It is therefore probable that the requested permission will be deferred. General Marshall says in his letter:

"If the work is permitted to proceed as at present, without interruption to the operations of the dredges during the night, it is hoped and expected that within the next four months one-half the channel, or a width of approximately 1,000 ft., will have been completed, and recommendations can then be made to congress for a modification of the law, with a view to throwing open this part of the channel to all deep draught vessels. This will make available for all such vessels, at all times, both day and night, a channel 1,000 ft. wide and 40 ft. deep, which can be used with perfect safety, since it then can be properly marked and the confusing dredging lights and buoys can be removed.

"Any premature opening of the partially completed channel to night navigation will seriously interfere with the plans of the department, will delay the opening of the 1,000-ft. channel as proposed, will increase the cost of the work and introduce possibilities of accidents that might entirely offset the excellent results in rapidity of execution and economy already secured.

"It has always been the intention of the engineering department to open a deep draught channel to navigation at the earliest possible date, and to that end it has been pushing the work day and night to complete one-half the channel and make this available first, and if navigation interests will exercise a little patience—a few months longer—this long desired result will be secured.

"There has been no intention of delaying the use of the channel until entire completion, or in fact beyond the time absolutely essential for securing a practicable channel of full depth."

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MARINE BOILER EXPLOSIONS.

[FROM THE BOARD OF TRADE REPORTS.]

Report No. 1675 deals with a mishap to the boiler of the Alert, when the vessel was moored in the river Thames, below Gravesend, on Dec. 27 last. The boiler is 26 years old, and the vessel for the last 5 years has been employed in pumping sand from the Thames, and usually lies on the Kent side, below Gravesend, at double anchor, for four or five days at a time. When moving up or down the river, she floats with the tide, the propelling engines being only occasionally used. When the vessel is employed as a sand sucker, steam is used in a pair of compound engines which operate a sand pump, and in a winch which is used to raise or lower the suction pipe. The explosion was not of a violent nature, a small hole locally corroding through at the bend of the back flange of the port furnace, and as the vessel was moored at the time it did not jeopardize its safety.

Report No. 1679 deals with a very serious breakdown of the main boiler of the steam trawler Socrates, last April. The boiler is of the usual single-ended marine type, fitted with three furnaces, and the working pressure is 200 lbs. The vessel was completed in June last year, since when she has been engaged in trawl fishing, off Iceland. On April 13 last, an entirely new crew joined the vessel at Hull, but the previous chief engineer was aboard, and worked the engines out of dock, and also whilst the compasses were being adjusted in the Humber. The vessel sailed about 8 A. M., and on the passage to the fishing grounds the water was very sluggish in the gage glass. The chief engineer did not, however, take any steps to test the condition of the water gage, neither did he try the test cocks. The vessel sailed on her return voyage on April 28, and though the water in the gage glass was discolored, the engineers do not seem to have apprehended trouble till a day or two later. The watch was relieved at 1:30 A. M., on April 30, and on blowing the gage glass through at that time the indications were unsatisfactory, but it appears that the orders were to "keep her going." Half-an-hour later a noise of leakage of steam was heard from the starboard combustion chamber. From this time onwards a large number of tubes began to leak, and by 3:30 A. M. the speed of the vessel had fallen from 10 to 6½ knots. The piston rods and valve spindles were also discolored, and there were other symptoms of unusual heat in the engine room, but the engineers do not appear to have understood the meaning of these signs. Matters got worse, till at 9 A. M. the port furnace crown commenced to come down, when the engines were stopped and the fires drawn. The blowdown cocks were opened, and shortly afterwards the lower water-gage pipe was disconnected, and it was found choked. After an hour's work it was cleared and replaced, wood plugs were driven into the worst of the tubes, a piece of asbestos cord was caulked around a stay that had given way in one of the combustion chamber tops, and the boiler was run up from the sea. On attempting to raise steam, the leakage was fortunately so great that the attempt had to be abandoned. A passing steamer was signalled, and the vessel towed to Aberdeen, and thence to Hull. The damage to the boiler was so great, owing to the utter incompetence of the men in charge, that the whole of the interior had to be renewed, only the shell and ends being retained.

Report No. 1680 deals with a mishap to the main boiler of the Race Fisher in May last. The vessel is engaged in the general coasting trade and left Barrow on May 18 for Llanelly, arriving there on the 20th. Owing probably to the fact that both engineers were new to the vessel, difficulty was experienced on the voyage round, and the second left her at Llanelly, another one joining before she sailed for Guernsey at 3:30 P. M. on the 24th with a cargo of coal. Soon after starting, the feeding arrangements gave trouble, and it was found that the main check valve was leaking badly, also that the after feed pump valve chest was cracked. After a stoppage of about 6 hours a fresh start was made, the donkey pump having to be put on to the feed, but its check valve was also leaky, and the valve seats in the pump were loose. As the water had left the gage glass, the anchor was dropped off the Mumbles at 9:30 A. M. on May 25, when one of the tube stoppers was found to have given out at the back end. When this was replaced, the vessel was able to get into Swansea under her own steam, but as one of the furnaces was defective, it was decided to fit a new boiler instead of repairing the one in use. Sufficient repairs were done, however, to enable the vessel to complete her voyage to Guernsey, and back to her layingup port.

Report No. 1681 deals with a mishap to the boiler of the steam trawler Columbia, in May last, when the vessel was off Shoeburyness, on her way from London to the fishing fleet in the North Sea. The vessel is engaged in carrying fish from the fishing fleet in the North Sea to Billingsgate market, and occasionally, when waiting for cargo, she also puts out her gear and trawls. On May 25, last, she left London, and after taking in bunker coal left Gravesend just after 6 P. M. The furnaces were fired about 8:40 P. M., and five minutes later a hissing noise was heard; this increased, and the stokehold became so filled with steam that it was impossible to enter it. The engines soon stopped for want of steam, and as soon as it was possible the stokehold was entered. The starboard fire was out in the stockhold and the other two fires were immediately drawn. The chief engineer then entered the starboard back end and found four stay nuts off the crown stays, and the crown plate collapsed clear of the ends of two stays. To account for this it is supposed that when the trawl, which is on the port side, is out, the vessel takes a list, which has caused in the past the starboard chamber to become bare and so get overheated and damaged, it being only a question of time afterwards as to when it would give way entirely.

Report No. 1682 deals with an explosion of a launch boiler near Greenock on May 18, last. The launch was the property of a boilermaker who obtained it about third-hand three years ago, but never made any inspection of it to ascertain its fitness for the recognized working pressure. It appears that the launch has been used for pleasure purposes only. New engines were fitted last winter, and on the date of the explosion the launch was being taken out for a trial trip, but had not preceeded more than 300 yards from its starting point when the boiler exploded, three men being blown into the water. The others paddled the launch to the shore where she settled on some timbers and became a total wreck. The cause of the explosion was the wasted condition of the furnace, the upper part collapsing at the back, and the crown was blown forward and fractured at the fore end.

FOUR DRY DOCKS FOR BREMERTON.

Rear Admiral Richard C. Hollyday, chief of the bureau of yards and docks, Washington, D. C., spent several days recently at the navy yard at Bremerton, Wash. He made a thorough inspection of the yard with regard to future development. In discussing the needs of the Puget Sound navy yard Rear Admiral Hollyday said:

"There are going to be four dry docks here. We are already planning for the third and expect to ask congress soon for money to start it, but may not get it this time; but, anyway, it is a good idea to agitate the subject. We can safely say that we will have four dry docks completed at this yard in the next eight years.

"We are also asking congress for

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$2,000,000 appropriation for the coming year. We expect a new pattern shop for the steam engineering department and several other much-needed shops, four officers' and two warrant officers' quarters, extension to railway, additional piers, electric system, roads, walks and paving and sea walls. The day before I left Washington a contract was awarded to Wellman-Seaver-Morgan Co., Cleveland, O., for a 100-ton floating crane, to cost $230,000. This is one of the most important additions that this yard has ever obtained. With it any of the heaviest turrets and guns can be lifted and there is nothing like it on this coast.

"Bids were openeed for the new hospital the day before I left, and we concluded that the contract would be awarded from the bids we received."

The contract has recently been awarded to C. J. Erricson, of Seattle, Wash., for the construction of a large dry dock at this yard, but owing to the death of Capt. E. E. Caine, who was one of Erricson's financial backers, there has been some delay in concluding arrangements. It is expected, however, that matters will be satisfactorily adjusted and work begun in a few days. A period of three years is allowed for the completion of the dry dock, but Rear Admiral Hollyday thinks that with proper progress it will be completed in two and one-half years.

TRADE NOTES.

The Independent Pneumatic Tool Co., First National Bank building, Chicago, Ill., have appointed the firm of H. W. Petrie, Ltd., 131 Front street, West Toronto, and 22 Victoria Square, Montreal, and Vancouver, B. C., as exclusive agents for the sale of the Thor pneumatic tools and appliances in the Dominion of Canada. A complete stock will be carried in their various stores.

The steamer Edward Y. Townsend delivered a cargo of 11,896 gross tons of ore at Ashtabula last week, the largest cargo ever docked at that port.

Repairs on the steamer D. B. Meacham have been completed.

The Galard Company, 31 Union Square, West, New York City, recently incorporated, contemplates shortly increasing materially the facilities for manufacturing its product. It is negotiating at the present time for a large manufacturing building in the vicinity of New York, and will be in the market for prices on machinery and general fittings, when negotiations are consummated. At the present time, the company is confining its operations to the manufacture of toilet seats and covers, high flush tanks, low flush tanks, medicine cabinets, bath stools, invalid trays, etc., producing a product that is absolutely unaffected by urine, alkalies, acids or gases; is pure white; never discolors or darkens; will not crack or flake off; is not inflammable, and is no colder than natural wood. Prominent architects, owners and builders, throughout the entire country, qualify the Omala fixtures as one of the most interesting and important additions to the building line in recent years.

After Sept. 1, the main offices of the Bird-Archer Co. will occupy the twenty-second floor of the West street building, New York City. The new offices contain more than four times the floor space of the present seven room offices. This quadrupling of floor space, made necessary by an unexpectedly large increase in business during the short time in which the company has occupied the present offices, certainly speaks well for Bird-Archer products and Bird-Archer business enterprise. It will interest progressive manufacturers to know that the Bird-Archer Co. did not recall its sales forces or retrench in any way during recent business depression and that this continued activity resulted in a practically normal American trade and an export trade which continued brisk without interruption. The demand for boiler compounds in the Orient especially seems to be very promising as the Bird-Archer Co. now sends out its Asian shipments in five-car lots. These are usually consigned to Pacific Coast agents who reship to the foreign agents and customers. Mr. P. B. Bird, president of the company, also expresses the opinion that American industry must be active in Cuba as the demand for their boiler compounds on the island has grown beyond all prophecies. The Bird-Archer Co. now has offices or representatives in every city of importance in the country and also has agents located all over the civilized world.

The Andresen-Evans Co., engineers, Monadnock building, Chicago, have just put out a beautifully printed catalog on their ore and coal handling plants and grab buckets. For its grab bucket the company claims great length of opening, positive opening power and powerful digging action. Length of opening is of course an important consideration in a grab bucket because in closing any bucket the greater the area over which the digging action of the scoops takes place, the more assurance there is that the bucket is full by the time the scoops are closed. Moreover, in unloading an ore vessel the problem is not so much to get out the ore directly beneath the hatches, but that which is beneath the deck. Unless a bucket has great reach, scraping device or hand shoveling is necessary to bring the ore directly beneath the hatch. It is claimed that by twisting the Andresen-Evans bucket around 90 degrees it is possible to reach underneath the deck and half way to the next hatch on account of the low head room required. It is claimed also for this bucket that it requires less head room than any other grab bucket or clam-shell bucket on the market. The catalog will be sent to anyone interested in this type of bucket.

The Sirocco Engineering Co.'s works at Troy, N. Y., are now engaged in getting out the fans for the forced-draught equipment of the United States battleships Delaware and North Dakota. These fans, which are 14 in number for each ship, are 27 in. in diameter and are to be driven by General Electric motors. The installation is noteworthy for the reason that it is the first large installation of the kind to be made on a vessel of the American navy, although the Sirocco turbine fans are in use on nearly all the big trans-Atlantic liners and in the navies of the principal fighting powers. The same company is also furnishing fans for torpedo boat destroyers Nos. 17, 18 and 19, on which the plenum system of draught will be used.

The submarine torpedo boat Octopus, commanded by Lieut. Charles E. Courtney, established a new record for itself in the matter of depth of operation during the maneuvers recently conducted at Buzzard's Bay. During one of the trials, the Octopus, with her whole crew aboard, maneuvered for an hour and a half in a depth of water, which at no time during the test was less than 107 ft. This is not the deepest that the Octopus has ever been down, for she was sent down 200 ft. off Boston Light, but there was no one aboard at that time. The Lake, in May, 1907, with her crew on board went down 135 ft. in Narragansett Bay, but the boat was not operated, thus the Octopus can claim the record of the deepest operating submerged record. At no time while the boat was so far under water did the crew feel any ill effects, none of the compressed air, which is always carried was used, and the air in the boat was still fresh when she came to the surface.

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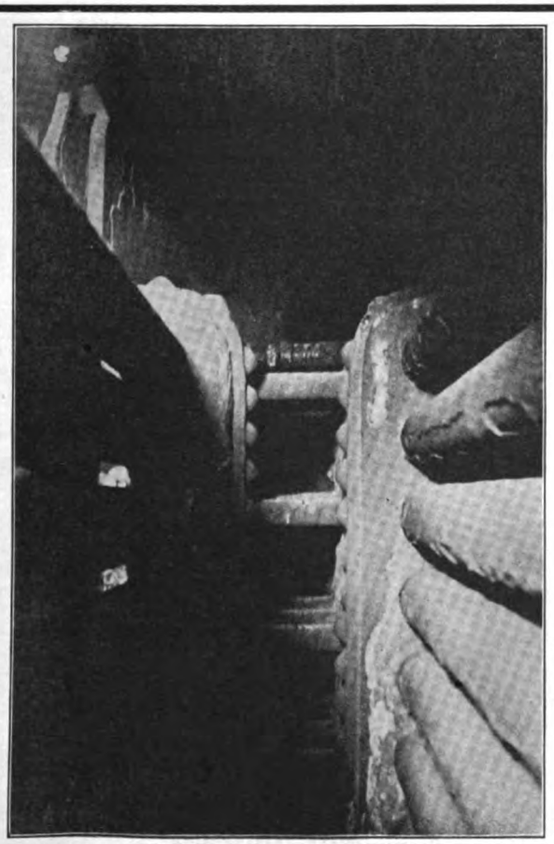

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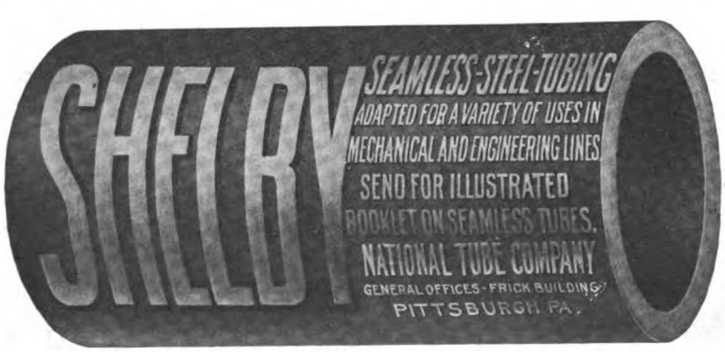
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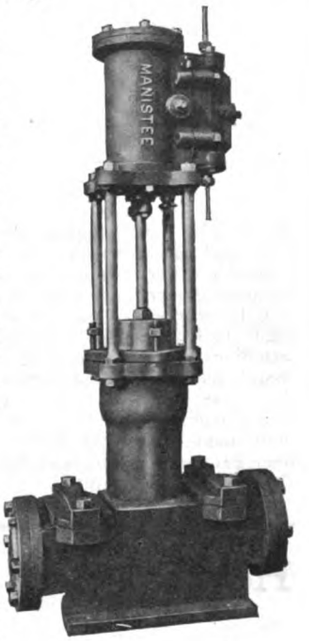


This photograph of the "MANISTEE" Upright Bilge Pump shows the 6-inch x 6-inch x 10-inch stroke pump. We make these pumps either upright or horizontal, in any of the following sizes:

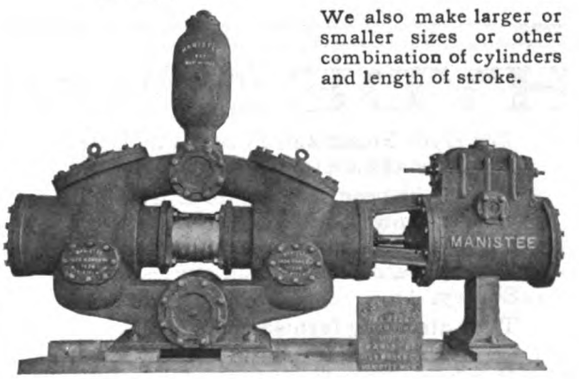
4″ x 4″ x 6″
5″ x 5″ x 8″
6″ x 6″ x 10″
8″ x 8″ x 12″
10″ x 10″ x 12″
12″ x 12″ x 12″

We also make larger sizes and other combination of cylinders or longer stroke to suit special requirements and floor space. They can also be made at any angle to fit on skin of boat if required.

This photograph of the "MANISTEE" Centrally Packed Plunger Pump shows the 18-inch x 12-inch x 24-inch pump. We make these pumps in the following sizes:

4″ x 2⅜″ x 5″
5″ x 3 ″ x 6″
6″ x 3⅝″ x 8″
7″ x 4 ″ x 8″
8″ x 5 ″ x 10″
10″ x 6 ″ x 12″
12″ x 7¼″ x 12″
14″ x 8″ x 12″
16″ x 10″ x 18″
18″ x 12″ x 24″
20″ x 14″ x 24″
24″ x 16″ x 24″
30″ x 18″ x 24″

We also make larger or smaller sizes or other combination of cylinders and length of stroke.



All of our pumps can be made with compound cylinders, if required.

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